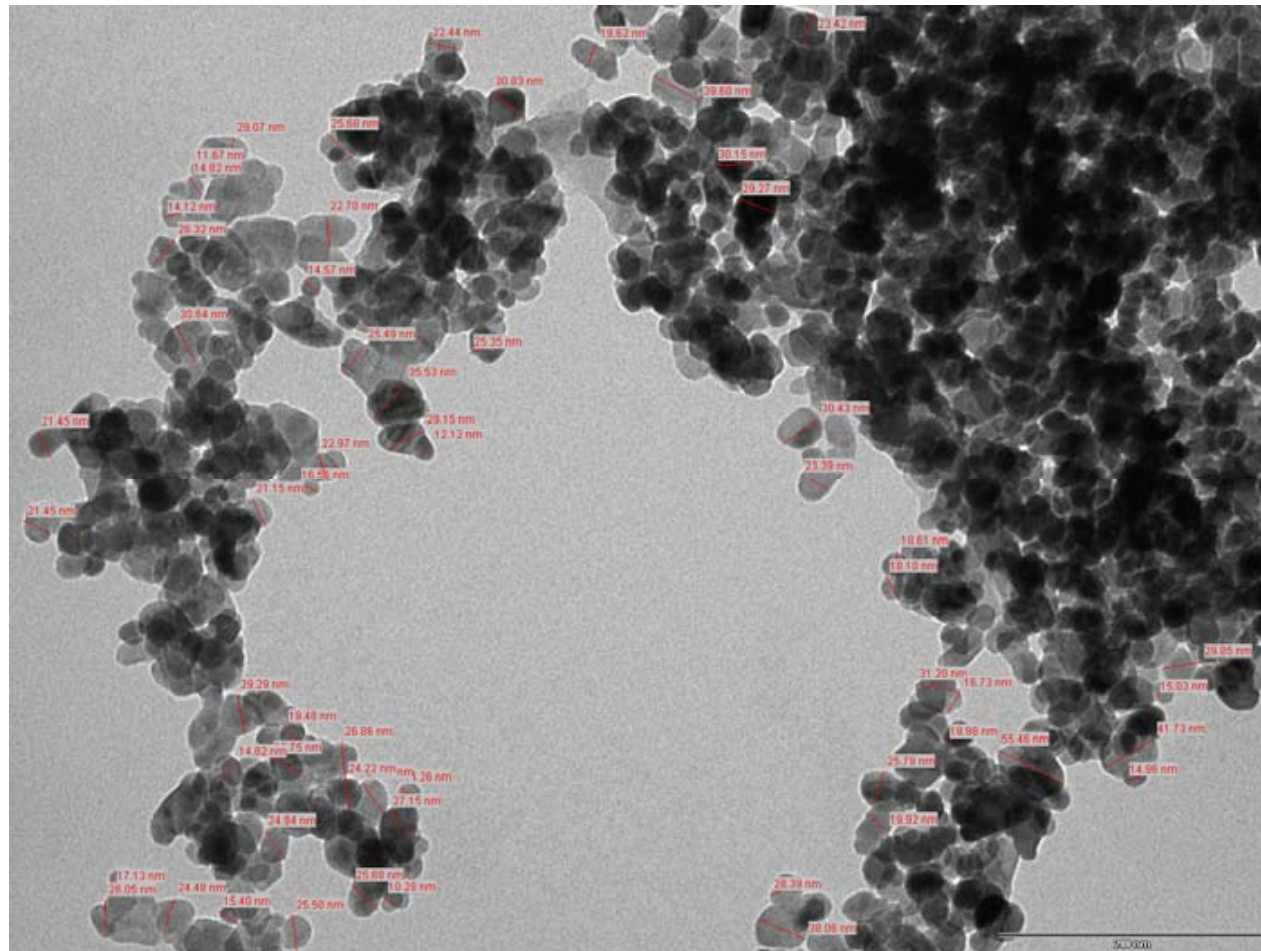


CSIRO Submission 09/358
 CSIRO's comments on the Enabling Technologies Strategy
 Discussion Paper
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*Image by Lynne Waddington, CSIRO Molecular and Health Technologies

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Introduction

CSIRO is a creative powerhouse that helps offer Australia better solutions to current and emerging issues affecting society, industry and the environment. As Australia's National Science Agency we have over 6400 staff across 55 locations. In 2007-08 our revenue was \$1.1 billion.

Our core and distinctive role in the National Innovation System (NIS) is the conduct of strategic and applied research that delivers economic, environmental and social benefits for Australia.

Our world class scientists seek to focus on the big issues facing the nation – such as water, clean energy, climate change and obesity. Our scientists are ranked in the top 1% in the world in 13 research fields.

We tackle the big problems and deliver new and practical solutions by forming large, transdisciplinary teams with diverse skills and expertise, who work in close partnership with others in the global innovation system as well as with those who benefit from our research. The globally unique breadth and depth of our scientific capability – from the atom to the universe - enables us to help drive beneficial change in Australian industry, the environment and society.

Within CSIRO we see the challenges and opportunities associated with the development and adoption of enabling technologies in the research and development context. Staying abreast of global research trends is vital to our success. Our annual Science Investment Process provides opportunity for our Executive Team to consider and address key issues likely to impact CSIRO's long-term success. Some examples of internal programs that CSIRO has recently developed to address emerging and converging technologies and capability platforms are:

- The identification and development of four transformational capability platforms (TCP) to catalyse and accelerate key cross-enterprise groups of capabilities. The four platforms are:
- Sensors and sensor networks: Realising the vast potential of sensors and sensor applications by stimulating multidisciplinary collaboration on a large scale;
- Transformational biology (modern post-genomic): Catalysing a step-change in biological capabilities by combining human, plant, and animal biology with genomics, phenomics and whole-of-system approaches;
- Advanced materials: Building programs that combine physics, engineering, chemistry and biology at an unprecedented scale to catalyse the development of the materials of the future; and
- Computational and simulation science: Enabling step-change growth in computation capabilities to accelerate delivery of next generation applications for industry and community.
- Direct investment in each TCP will enable a step change in CSIRO's research capabilities on a scale and scope beyond what is possible for any single research project or Division. Science networks are being funded to foster the connectivity and integration required for success.

- Flexible capability development funds have been made available to all Divisional Chiefs. Divisions are the stewards of CSIRO capabilities, and providing a small amount of funding outside the normal project regime allows our Science Leaders to investigate and quickly address newly emerging science trends and emerging technologies.
- The development of strategies to address CSIRO's role in rapidly changing contexts such as services, the bioeconomy and e-Research.
- The creation and funding of a dedicated research theme¹ within the Future Manufacturing Flagship to address emerging nanosafety issues.

However, the issues associated with emerging enabling technologies are not just issues for CSIRO to solve internally and in isolation. Enabling technologies are critical to the continued and future impact of research providers in the NIS for the benefit of Australia. As such, CSIRO welcomes the Government's discussion paper on the development of the National Enabling Technologies Strategy (NETS).

We applaud the Government's intention to provide national coordination on key facets of the strategy – such coordination is critical and there is a clear role for central government (via DIISR) to provide the social 'glue' to bring key parties together – research providers, industry and society. There is also a clear role for government as policy-makers to pro-actively address national policy and legislative matters.

Key lessons learned from both the National Biotechnology Strategy (NBS) and the National Nanotechnology Strategy (NNS) must be captured and considered. These strategies have had some positive aspects as well as providing learnings for improvement. The development of the new NETS provides the opportunity to build on successes of the earlier work.

The new strategy is also an opportunity to bring other emerging enabling technologies into scope – or at least, not leave them out. Biotechnology and nanotechnology are clearly the most widely known enabling technologies at the moment, but it is not possible yet to definitively predict what technologies will be important in five or ten years time. The analysis and foresighting aspects of the new strategy will prove important for addressing emerging technologies.

Critically, the new NETS must be accompanied by adequate resourcing and commitment to a suitable length of time. To an extent we are all 'learning as we go' about the challenges and opportunities associated with emerging enabling technologies and so the time element becomes especially pertinent.

What follows in this paper are some more specific feedback on CSIRO's experiences with the NBS and NNS and responses to some of the specific questions highlighted in the discussion paper.

Again, CSIRO welcomes the opportunity to provide comment on the proposed NETS, and looks forward to further future positive engagement.

¹ A theme is an aggregation of research projects, and is the major unit of investment at the CSIRO enterprise level.

Lessons from the National Nanotechnology Strategy and National Biotechnology Strategy

1. Experience with the National Biotechnology Strategy (NBS)

CSIRO has worked with the former Biotechnology Australia (BA) since its inception almost ten years ago. During that time the biotechnology industry has been formed, a regulatory framework implemented, a Commonwealth-State cooperative environment evolved, and a much more mature public debate on the use of biotechnology has developed.

Aspects of the NBS that worked well were the communication strategy, particularly the longitudinal public opinion surveys; the national capability mapping; the State consultative mechanisms; and the development of an agreed statistics framework to measure economic impact of biotechnologies. However, there were other areas under the NBS that were not sufficiently advanced, in particular the understanding of landscape-wide impacts of genetically modified organisms (GMOs) beyond the realm of the regulators.

Towards the end of its term, the NBS was beginning to lose momentum and the need for a fresh approach was evident. The current pause in the strategy provides the ideal opportunity to develop a fresh, inclusive strategy with a forward looking perspective whilst incorporating experiences from the past.

2. Experience with the National Nanotechnology Strategy

1. Nanotechnology HSE Working Group.

As part of the NNS, the Australian Office of Nanotechnology coordinated a Nanotechnology Health Safety and Environment (HSE) Working Group. Meetings of the HSE Working Group were attended by representatives from all Government Departments with a stake in nanotechnology, including CSIRO.

From CSIRO's perspective, the meetings were very useful, as a key aim of our nanosafety research was to do research that contributed to a stable regulatory environment for manufacturers working with nanomaterials. To do this required identifying, and working with, key people in Government Departments and agencies. Without meetings of the HSE Working Group, the process of identifying key people in relevant departments or agencies would have taken considerable time.

As a direct consequence of relations developed through the HSE Working Group, CSIRO co-invested with the Department of Environment, Water, Heritage and the Arts (DEWHA) and SafeWork Australia on several nanotechnology HSE research projects. CSIRO also worked with the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) to establish an Australian consortium of research institutions participating in the OECD program for the safety testing of a set of manufactured nanomaterials.

It should be noted that, although networking across Government Departments was greatly facilitated by the HSE Working Group, the relationships still took time to develop and only came to fruition (as evidenced by exchanged contracts for experimental research) in the second year of the NNS (upon cessation of the Strategy). Strategies with short time spans can be wasteful because the lead time before things "get going" forms a

large proportion (and budget) of the total program. It would be helpful if the NET Strategy could run its full time-frame.

2. Communication

CSIRO have been involved in the public awareness programmes of both the BA and the NNS. CSIRO scientists partook in secondments to BA as well as BA staff development initiatives to establish a healthy dialogue between the policy and the technical communities.

As part of the NNS, the Australian Office of Nanotechnology (AON) ran a public awareness and engagement program on nanotechnology and CSIRO scientists participated in several public fora in the AON's program. CSIRO directly received numerous requests for information about nanotechnology from the media (TV, radio, newspapers, magazines), and some referrals from the AON when expert comment was needed.

It is clear that the Australian public and industry are receptive to the provision of information on emerging technologies. As a result of this increased interest, CSIRO scientists have at times found their time to do research limited. Whilst in the normal course of events this would not be of concern it has now reached a point where the quantum of enquiries is affecting CSIRO's ability to both conduct the necessary research and communicate on issues related to nanotechnology.

Consequently, to take advantage of this interest and receptiveness to information on nanotechnologies and to maintain the high quality research undertaken by CSIRO, it is appropriate that additional resources be allocated to cover the public dissemination of knowledge through the appointment of a dedicated communications professional and that this role is best managed in the proposed Public Awareness and Community Engagement component of the strategy.

Specific questions:

We welcome the opportunity to provide input on the questions for consultation posed in the National Enabling Technology Discussion Paper. We do this from our perspective as researchers in the area of environmental and human health.

What are the key issues and challenges that need to be addressed by the National Enabling Technology Strategy?

It would be important to have a fresh perspective on enabling technologies that goes beyond bio- and nanotechnologies. Equally important will be to have a stronger, more forward-looking strategy than the NBS and work closely with research organisations to understand issues involved in developing these technologies, to understand the longer term impact they may have on society, and to address the related policy challenges.

For instance, the OECD has recently released a futures study for the Bio-economy in 2030, which notes that at present 87% of the current share of OECD business expenditure on biotechnology are directed towards health outcomes, whereas in 2030 the agricultural and industry sectors may likely provide 75% of the gross value added benefit from new bio-industries and technologies. This will require a mega-shift to reposition industries and research providers. This shift has to coincide with a strong engagement with the international policy community. CSIRO notes and welcomes the intent to work with the

OECD on these matters; it is imperative that Australia is well aligned with policy and technical developments amongst our trade partners and competitors.

Compared to the biotechnology policy and regulatory framework, nanotechnology is still in its infancy. It is, however, important that the lessons learnt from the biotechnology journey are applied and the same mistakes not repeated. A key requirement of any new products based on nanotechnology will be that their use poses no threat to human or environmental health. This will need to be managed in accordance with appropriate government regulations and policies. Current research is indicating that it is not appropriate to assume that the impacts of nanomaterials will be the same as micro- or macroscopic forms of the same compounds, and that their smaller size gives them distinctly different properties with respect to their fate, and transport and uptake by humans and other life forms.

The NNS that operated from 2007-09 had as a priority 'to address the HSE impacts of nanotechnology on regulations and standards'. However, upon termination of the NNS, a stable policy and regulatory environment that meets the needs of society, industry and researchers have not been formulated.

Without more urgency in the regulatory sphere, industries are likely to be reluctant to invest too heavily in nanotechnologies as there is no certainty that their products will be acceptable to society.

Today's public is fully attuned to such issues and new developments are subject to scrutiny by NGOs, trade unions and the media. These bodies are already calling for government action. Such publicity has the potential to destabilise a potential growth area.

How should these issues and challenges be addressed? What is your organisation doing to address these issues and challenges?

CSIRO considers the horizon scanning / technology foresight exercises as mentioned in the discussion paper a crucial part of the implementing the strategy. We suggest that such foresighting exercises draws on the national directions and capabilities within the major research providers as they are the source or 'engine room' for new enabling and general purpose technologies.

It is also useful to consider how the learnings from BA's public awareness program can be expanded into other technologies and provide formal feedback into the research environment on upcoming issues and potential concerns to avoid getting into similar situations as experienced with GM crops.

Specifically, key HSE issues in other enabling technologies such as nanotechnology need to be fully research before constructive and meaningful regulatory frameworks can be put in place.

There are two ways in which HSE issues can be addressed:

- We could wait until research is done overseas and overseas regulators (e.g. USEPA) release recommendations of nanomaterial risk; or
- We could undertake specific research on nanomaterials manufactured and used in products being developed locally, and proceed with the introduction of local regulations and contribute to achieving consensus on global regulations.

The first approach severely disadvantages Australian industry. If they have to wait until international regulations are in place, international industries will gain a head start in obtaining a market foothold. Also products suited to an overseas environment may not be appropriate here in Australia, thus requiring research with an Australian focus in some instances.

The second approach gives Australia the opportunity to take the lead in dealing with specific nanomaterials both through research and regulation, giving its activities international credibility and an imprimatur to participate in information exchange with overseas peers and agencies.

CSIRO, through the nanosafety theme in the Future Manufacturing Flagship, has achieved considerable success in its limited activities dealing with metal oxide nanomaterials in the environment and human health over the past two years. Its scientists have been co-authors of several important publications in the field and are now established internationally as important research players. Nationally, it has achieved a high profile with limited resources.

Together with NICNAS and NMI, CSIRO is leading activities in Australia in the OECD's Working Party on Manufactured Nanomaterials, seeking to develop standard measurement protocols.

The Government regulatory environment would ideally be premised on/underpinned by a solid understanding of the risks involved. This can be accomplished through a comprehensive R&D program to understand essential health and safety aspects of nanotechnologies. It is apparent that the current level of activity is not sufficient to support such a need. Research activities therefore need to be bolstered to achieve the potential that is inherent in the development of a nanotechnology industry sector in Australia. The potential for achieving the necessary HSE research may be achieved through national consortia such as is being done for OECD. In this case CSIRO would be willing to take the lead with the appropriate support from Government.

What would you like to see as the main outcomes for the National Enabling Technologies Strategy?

The NBS has only been partially implemented, several strands of which require further policy attention (e.g. disparities between State and Federal legislative requirements) and, ultimately, funding and support. These include the national bioinformatics strategy, the national consistent approach to biodiscovery, biotechnology statistics and impact metrics, next generation GM crops, the industrial biotechnology strategy, etc.

In addition CSIRO has identified that a National Enabling Technologies Strategy would, as a matter of some criticality, also have to balance the issues identified above against the following emerging needs:

- The development of a fully funded five-year research plan - to be developed by relevant Government departments in conjunction with CSIRO, NMI and ANSTO to address Australia's HSE requirements relevant to manufactured nanomaterials;
- The establishment of an overarching coordinating mechanism (IDC or commonwealth state liaison structure) to coordinate activities at the national level (to include representation by CSIRO). Possibly through a virtual Institute?
- The development of an international strategy to support involvement in appropriate international activities and to leverage information being developed

overseas, this could be support for Australia's participation in the OECD program;

- The establishment of a clear "statement of expectations" at the outset of the NETS clarifying responsibilities of the parties.