A Snapshot of the Productivity Commission's Draft Report on *Pubic Support for Science and Innovation* from the-funneled-web.com (November 4, 2006)

The 700 page draft report on the state of governmental support for Australian science and innovation and what should be done about it is divided into 11 sections and each is introduced with a set of *Key Points* plus an overall set.

Below we set out the 12 sets of key points, which are in effect, an executive summary of the report.

Overall key points

1. Australia is well served by its public funding support — some $6 billion in 2002-03 — for science and innovation.
   – It is not possible, given a host of measurement and methodological issues, to provide accurate estimates of the contributions of such R&D to the economy, but indications are that they are significant.
   – There are also important social and environmental dividends for Australians.

2. There are no grounds for a radical overhaul in total public funding or in the allocation of that funding. However, incremental improvement is needed in some areas.

3. The adequacy of existing evaluation arrangements is mixed, with some notable shortcomings in business programs.

4. The net payoff from the R&D Tax Concession could be improved by orienting the program towards its 175 per cent incremental component. This offers the prospect of increasing the amount of new R&D encouraged per dollar of revenue allocated to the program. The design of the incremental component could also be improved to make it more attractive and efficient.

5. Strong public support of Rural R&D Corporations with a public good orientation is justified, but the level of government subsidies for some more narrow industry focused arrangements may crowd out private activity and produce only weak external benefits outside the supported rural industry. However, no changes should be made while persistent drought conditions remain.

6. Although, collaboration can generate significant benefits, the CRC program is only suited to longer-term arrangements. The Commission has outlined some complementary options for business collaboration with public sector research agencies and universities that could provide more nimble, less management intensive, arrangements than the present CRC program.

7. There is a wide range of perceived obstacles to commercialisation by universities, but only some of these warrant policy action.
   – There may be a case for providing universities with some additional funding to demonstrate promising technologies so they can be more easily transferred to businesses. However, there are several options for supporting such transfer that do not involve a new dedicated funding stream.

8. The structure of funding for higher education research has increasingly eroded the share of block grants. Further erosion would risk undermining their important role in enabling meaningful strategic choices at the institutional level.

9. While the proposed Research Quality Framework has some benefits, it also has considerable costs. The Commission suggests that a final decision about its implementation should be delayed pending the exploration of some other options.

---

1. Introduction

1. This study has three major aims:
   – to assess the impacts of public support for science and innovation;
   – to identify any major impediments that affect the operation of the innovation system

and the scope for mitigating such impediments; and
– to evaluate frameworks for assessing where and how public funding should be allocated, including any scope for improvements.

2. The Commission has adopted conventional definitions of R&D and science. The definition of innovation is a broad one and entails deliberative processes by firms, governments and others to add value to the economy or society by improving products, services, processes or organisational forms. Catch-up to global frontiers is included as innovation and is one of the most important drivers of economic growth.

3. While there are strong private incentives for imitation and catch-up, these do not always apply to the generation of R&D. This is why, despite occupying a small part of the innovation terrain, policies relating to science and R&D justifiably occupy a large part of public innovation policy in general.

---

2. A snapshot of Australia's science and innovation system

1. Direct government support for science and innovation has been concentrated on research funding for universities, CSIRO and other public agencies, rather than business R&D and other knowledge assets.

2. Where business support is provided by the Australian Government, it is overwhelmingly aimed at stimulating R&D, rather than commercialisation or diffusion of ideas.

3. Around half of the direct funding support of the Australian Government for innovation is directed at basic research of some type, significantly more than any other actor in the system, including State, Territory and Local governments.

4. Industrial production and technology are the principal targets of Australian Government support, followed by human health, which has been assuming a greater importance. The relative importance of support for agricultural research has been falling.

5. It is common to assert that the various research-performing institutions fulfil relatively rigid roles in the Australian system. This is true for some sectors. Business principally undertakes applied and experimental R&D; public sector research agencies tend to undertake strategic basic and applied research. But higher education institutions undertake a broad mix of research types and not primarily basic research, as often thought.

6. International comparisons suggest Australia has about the average business innovation propensity, but a low relative BERD to GDP ratio. There are many reasons why such unadjusted comparisons should not be used as a basis for policy arguments for changes in public support.
– For example, variations in business R&D intensities across countries only weakly explain variations in business sector innovation propensities.

7. Australia has been converging to have a pattern of R&D more like that of the typical OECD country, with a greater weight towards business R&D.

---

3. Rationales for public support

1. Public support of science and innovation should be based on clear and credible rationales. These also help in designing appropriate support mechanisms and, where empirical evidence on impacts is absent or uncertain, enable policymakers to better judge whether particular forms of public support are likely to produce net benefits.

2. The strongest reason for directly supporting science and innovation is spillovers from innovation that cannot be captured by the innovator and that cannot be realised without support.

3. The spillovers may arise through high quality human capital development, the development of basic knowledge capabilities, the resolution of public good problems and diffusion of new ideas among firms and others. They arise from research undertaken in universities, businesses and public sector research agencies.

4. While spillovers provide a strong rationale for public support, it is important to note that:
   – not all research in universities and public sector agencies create significant spillovers, especially if research is mediocre or research is poorly managed;
   – not all spillovers matter for policy;
   – some apparent spillovers are illusory; and
   – the areas where public support for commercially-oriented R&D is likely to produce the biggest spillovers depend on the methods used to 'absorb' knowledge generated by others, the costs of absorption and the nature of the R&D being absorbed.

5. Spillovers not only provide a rationale for public support, but pinpoint other policies that are important in increasing the effectiveness of an innovation system. These include measures that reduce the costs of absorption (such as skill upgrading) and facilitate research cooperation.

6. Other reasons for public support with some validity are:
   – intangible factors such as national identity and prestige, which relates mostly to scientific research in universities and public sector research agencies;
   – the asymmetric tax treatment of highly risky investments, which mainly relate to R&D undertaken in small or newly created businesses;
   – with strong provisos, problems in capital markets that could affect the availability of finance to risky or uncertain investments in small firms and start-ups; and
   – problems in information provision by public sector agencies.

7. Some cited reasons for supporting the system, such as indivisibilities, business myopia, and the aspiration to achieve a transformation of Australia's industry away from its present structure have weak validity. In many instances, they would entail completely different support arrangements than those currently observed.

---

4. Impacts

1. Economywide productivity is closely linked with improvements in R&D. Evidence for this linkage within Australia includes:
   – aggregate time series studies;
   – panel data analysis across Australian States;
   – cross-country results;
   – models of innovation; and
   – case studies.

2. It is not possible, given a host of measurement and methodological issues, to provide accurate estimates of the social rate of return on R&D for Australia, but spillover rates could readily lie between 35 and 100 per cent.

3. The relevant issue for public policy is the magnitude of benefits from public funding for science and innovation, not science and innovation in general.

4. Existing information suggests that government spending on R&D effectively increases national R&D and does not, to any substantial extent, substitute for privately-funded R&D. This is important because significant crowding out would reduce the potential for positive net impacts from public funding support.

5. The Commission judges the benefits are likely to be high for R&D in universities and public sector research agencies, due to their greater orientation to public good research and their role in development of high quality human capital for the Australian economy.
   – This is backed by case studies and some econometric evidence, though the latter is not robust.
   – Other indirect indicators of academic quality suggest that Australian scientists are performing as well as in other advanced economies.

6. Because of the nature and structure of business programs they are likely to have had smaller absolute impacts:
   – This is mainly due to the extent of public funding support, which is relatively (and appropriately) small-scale.
   – Considerable public support has been given to a few sectors that are contributing relatively less to the economy.

7. The Commission judges that publicly funded science and innovation have produced important social and environmental benefits. It is difficult to enumerate these benefits, but research appears to have:
   – increased national preparedness and reduced risks in some areas; and
   – been widely adopted in a range of settings (public health, risk abatement in the environment and social and educational policy).

---

5. Impediments to the functioning of the innovation system

1. Participants identified a range of possible impediments to the operation of the innovation system. These mainly related to perceived deficiencies in public support programs. Remaining identified impediments focused on skills development, intellectual property rights, research infrastructure, privacy and ethics regulation, and scientific publishing.

2. There are recognised shortages in engineers and science and mathematics teachers. The shortages in engineers have been reflected in rapid growth in salaries. In the case of science and mathematics teachers, such price signals have not operated as effectively due to inflexible pay levels and structures. These shortages may have been accommodated by using teachers without adequate skills in science and mathematics, which may adversely affect student interest and competence as well as decrease future university enrolments. Introducing greater flexibility in teacher pay levels and structures would make teaching more attractive to prospective entrants, including those with science and mathematics qualifications. It would also provide greater scope to attract and retain skilled teachers, not only across the board, but in areas of particular shortage.

3. Legal uncertainty about the use of patents for research has the potential to impede knowledge dissemination. One option proposed by the Australian Law Reform Commission and the Advisory Council on Intellectual Property is to introduce an experimental use provision in the Patents Act. However, the extent to which legal uncertainty actually acts as an impediment is unclear, as are the costs and risks of implementing the proposed option.

4. There is poor utilisation of research infrastructure. This could be improved through owners of major research infrastructure charging to recover marginal operating costs (supplemented as appropriate with a congestion charge) and enabling third party access or, at least, making access entitlements transferable. Enhancing information about the existing stock of research infrastructure could also improve utilisation.

5. Privacy regulation is having adverse effects on medical research due to the complexity caused by the intersection of Australian Government and State and Territory laws. National consistency in privacy regulation of health information should be progressed by the Australian Health Ministers' Conference as a matter of priority.

6. The ethical review processes of human research ethics committees are impeding health and medical research, particularly, across multiple institutions. State and Territory health agencies should seek to streamline ethical review processes as expeditiously as possible. National consistency could also be beneficial.

7. There is scope for the ARC and the NHMRC to play a more active role than they currently do in promoting access to the results of research they fund. They could require as a condition of funding that research papers, data and other information produced as a result of their funding are made publicly available such as in an 'open access' repository.

---

6. Commercialisation and utilisation

1. There is often a degree of pessimism about Australia's commercialisation performance. However, Australia's economic performance over the last fifteen years suggests that such concerns may be overstated.

2. Australia's commercialisation performance should not be seen as dependent on growing any particular set of knowledge-intensive industries or transformational high-tech firms. Australia's success in commercialising knowledge and technology is often in areas that are close to its traditional comparative advantages in the mining and agricultural sectors.

3. There is a wide range of perceived obstacles to commercialisation, such as: size and distance; financing; incentives within universities; cultural barriers; a lack of effective linkages between research organisations and firms; intellectual property management; and skill shortages.
   – Some of these apparent impediments do not provide a compelling basis for intervention. Governments are generally already taking steps where needed.

4. One possible exception is addressing the impediments within universities that constrain the transfer, diffusion and utilisation of knowledge and technology.
   – Flexible arrangements should be developed to allow universities to draw on the commercial expertise they need in the most efficient and cost-effective way.
   – There may be a case for providing universities with some additional funding to support knowledge transfer to non-academic communities. However, there is a number of options for supporting such transfer that do not involve a new dedicated funding stream.

5. Ultimately, in terms of community wellbeing, it is the transfer, diffusion and utilisation of knowledge and technology that matters. Commercialisation is only one of the pathways along which this can occur.

6. The Commission does not support increasing the level of public support for business commercialisation.
   – Generally, there is not a strong case for government intervention on public good grounds.
   – It is not the role of government to 'de-risk' highly risky commercial ventures.
   – Governments may end up subsidising projects with poor commercial prospects.

---

7. Performance evaluation and benchmarking

1. Effective performance evaluation and benchmarking helps to achieve a number of important goals, particularly in relation to the allocation of public (and private) funds firstly to programs and, secondly, to projects within those programs.

2. Various types of measures can be useful including effectiveness measures which assess a program's outputs and outcomes in terms of its defined objectives, and efficiency measures which assess resource use.
   – Measures can be usefully applied in three ways: backwards looking evaluation of results; monitoring of current progress; and estimation of future performance.

3. With some activity, for example basic research, suitable output measures can often be used as helpful proxies for measures of outcomes.

4. Performance evaluation is enhanced by: specifying desired outputs and outcomes (that is, objectives) consistently; factoring performance measurement into initial program design; considering how best to assess quality and impact; providing appropriate independence and transparency of assessment; and ensuring measurement results feed back into program design.
   – Isolating the effects of public support from the many other factors which can affect outputs and outcomes is important but difficult.
   – Performance measurement system design should trade off the advantages of greater sophistication and precision against additional administrative and compliance costs.

5. The adequacy of existing performance evaluation and benchmarking is mixed. There are some notable shortcomings, particularly in relation to business and rural programs. As well, the outcomes from higher education block funding are not transparent and thus difficult to assess. Some arrangements appear very sound in principle, but scope remains for further improvement.

---

8. Funding levels, funding mix and coordination issues

1. In theory, public funds should be allocated to science and innovation whenever the net social benefit of marginal spending remains both positive and exceeds the next best alternative use.

2. However, in practice, the information requirements to determine the optimal scale and mix of public funding for science and innovation are too demanding.
   – These are matters of political judgment, informed by the available evidence.

3. International comparisons and examination of a range of domestic socio-economic indicators do not support a contention that the overall quantum or mix of public funds allocated to science and innovation is inappropriate for Australia's needs and aspirations.
   – Any science and innovation spending targets for Australia should be expressed in relation to those needs and aspirations, rather than in relation to overseas levels. International benchmarking should only serve an informative, not prescriptive, role.
   – There are dangers if the trend towards publicly funding applied problem solving and commercialisation, at the expense of basic and strategic science and innovation, goes too far.

4. The existing policy and budgetary processes of government provide a reasonably satisfactory mechanism through which information flows and advice can be integrated to facilitate decision making.
   – These processes generally support an incremental approach to change — with a reliance on diversity and devolution.
   – Program evaluation and feedback are critically important. They are in need of improvement (as discussed in chapter 7).

5. There is no need to markedly strengthen existing coordination mechanisms, or create new ones, in relation to the high level institutional arrangements for funding of science and innovation programs.

6. The disadvantages of greater specification and quantification of National Research Priorities would outweigh the advantages.

---

9. Business programs

1. The inherently uncertain nature of science and innovation processes and outcomes poses challenges for programs aimed at supporting these activities. Their primary goals should be to encourage activity that would not take place without public support (additionality) and deliver benefits not appropriated by the R&D performer (spillovers). Designing programs to achieve these goals is not easy.

2. Australia's current suite of business programs do not effectively target these objectives and, as a consequence, involve substantial transfers from taxpayers to firms without attendant net benefits. The need to raise taxation revenue to fund these transfers creates efficiency losses for the community.

3. Of particular concern is the basic R&D tax concession because it is available to all eligible firms whether or not the R&D would have been performed without support. It also assists R&D with low levels of spillovers such as incremental innovation. The effectiveness of the program could be improved by rebalancing support toward the premium component. That component could itself be improved by moving to a scheme

based on changes to a firm's R&D intensity from a fixed base period. Modifications to the beneficial ownership requirements and access to the premium component by start-up firms could also be made.

4. In principle, competitive grant programs such as Commercial Ready provide greater scope to target socially valuable R&D projects that would otherwise not proceed. However, the current focus on the commercialisation end of R&D can work against the selection of projects with those characteristics. Introducing repayment or benefit sharing arrangements might provide scope to improve project selection.

5. There are strong grounds for public support of RRDCs that provide spillover benefits beyond industry members where R&D would not proceed in the absence of support. But there is only a weak rationale for the present substantial co-funding of some industry-centred RRDCs. However, any changes to current arrangements should be delayed until current economic conditions in the rural sector have improved.

6. Although assistance to automotive R&D is generous in comparison to other sectors, this needs to be viewed in light of the transition to a lower tariff environment.

7. The complete shift to industry-focused CRCs is inappropriate. In addition, current cost sharing arrangements do not appear to reflect the distribution of benefits from the program, with potentially large subsidies available to business partners. Given high associated compliance costs, consideration should be given to introducing a complementary arrangement to support smaller-scale and short term collaborations between groups of firms either independently or without universities and public sector research agencies.

---

10. Public sector research agencies

1. The objective of public sector research agencies is to perform socially beneficial strategic and applied scientific research that would not, or could not, be conducted by other research providers and, where appropriate, widely diffuse the results from that research.

2. Australia devotes a relatively high proportion of its total science and innovation budget to public sector research agencies compared with other countries. It also has a multiplicity of such agencies, although CSIRO and the DSTO dominate the funding allocated to these bodies.

3. Recent changes to CSIRO's research investment processes have improved its research focus and provide a framework for ensuring that the organisation does not perform research that the private sector would otherwise undertake. Given the scale of CSIRO activity and the dominance of small and medium sized firms in Australia's industrial structure, it is also unlikely that CSIRO crowds-out private sector research effort.

4. Block appropriation funding for CSIRO needs to be sufficient to enable the organisation to make appropriate strategic investment decisions and to maintain its research capability in a range of areas. The share of CSIRO's revenue from that source has declined considerably over the last few years. The real level of block funding should not be reduced.

5. Aspects of CSIRO's approach to priority setting and performance management may have wider applicability to other parts of Australia's innovation system (for example, other Federal and State public sector research agencies and the CRC program). The aim of adopting such an approach would be to reduce the risk of unnecessary duplication of research effort and increase accountability across that system.

6. The effectiveness of research conducted by the DSTO depends critically on the procurement practices and research directions set by its principal customer, the Australian Defence Organisation. An option to facilitate greater contestability might be to review the potential for providing a component of research funding directly to the users of DSTO research allowing them, if they wish, to allocate funds to external providers.

11. Funding of higher education research

1. The rationales for dual streams of funding of higher education research are sound.
   – An appropriate balance of block and competitive funding should be maintained. In particular, as block funding levels should be sufficient to enable meaningful strategic choices to be made at the individual institutional level their share should not be reduced further.

2. Differing funding allocation methodologies — for example formula-based approaches and peer review-based approaches — should be evaluated in a benefit–cost framework against relevant criteria.

3. There is no clear objective evidence pointing to deficiencies in the quality of research currently funded through block grants. There is, however, evidence that the RQF will bring costs as well as benefits but, at this stage, it is not possible to assess the balance.
   – The Commission would suggest that it is still too early to make a final decision about implementation of the RQF, one way or the other.

4. The Commission would suggest that adoption of the RQF should be delayed, pending the following investigation and analysis:
   – continue with limited trials, based on RQF peer review principles, but focused on providing indicators of the quality and impact of research dependent on block funding;
   – examine whether current procedures within institutions are sufficiently rigorous to promote the quality and impact of block funded research;
   – examine what benefits, if any, fine tuning of existing block funding formulae could bring; and
   – examine the merits of externally applied, risk-minimisation, approaches to enhancing the quality and impact of block funded research applied in conjunction with formula-based funding.

5. In regard to competitive funding, little, if anything, would be gained through amalgamating the ARC and the NHMRC.