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1. Limitations of the conceptual framework adopted in the report

In evaluating public support for science and innovation, the report needs to do more than determine whether public support is justified in terms of the traditional concepts of market failure associated with externalities, spillovers and public goods. These dimensions of market failure are associated with economic models in which scarcity is the primary economic problem and market forces operate so as to achieve long term equilibrium. These models typically assume that if there are appropriate incentives for innovation then firms will innovate.

Instead, science and innovation policy needs to be evaluated through models which take into account the particular features of the current international economic context; a context in which the competitiveness of firms, industries and nations is not linked to comparative advantages but is determined by strategic advantages arising from well developed business competencies and variety in research and economic activities, which are stimulants to innovation. Models which assume long term equilibrium as the normal economic state have limited application in the context of rapidly and continually changing markets, industries and firms. Models which assume that innovation will occur naturally in the market provided there are sufficient incentives cannot be reconciled with empirical research on innovation which has shown that innovation depends on the existence of structures or forms of economic organisation that facilitate interactive learning rather than economic incentives alone. A new conceptual framework is required to evaluate science and innovation policy based on a deeper understanding of contemporary economies.

Submission 1: The heavy reliance on traditional economic models as the basis of the report's reasoning and analysis undermines the usefulness of the findings in addressing key problems associated with innovation performance

2. An innovation systems framework

New conceptual frameworks need to identify the mechanisms that stimulate the generation of new ideas and the processes leading to their commercial application. The performance of science and innovation policy should be measured with reference to whether it is successful in encouraging institutional environments and forms of economic organisation that stimulate innovation. This need not involve substantial public expenditure.

The most recent insights in the field of economic geography and innovation studies demonstrate the importance of interactive processes as the basis for innovation. This research shows that there are certain forms of economic organisation that are associated with higher levels of innovation. These are the forms of economic organisation that result in the combination of different types of knowledge through interaction between a variety of different

organisation and institutions including firms and research organisations. In addition, reflexivity (reflection on practice leading to chance in practice) is a critical dimension of organisational processes leading to innovation. Science and innovation policy should be evaluated with reference to whether it stimulates these forms of economic interaction and organisational learning processes which have been shown to be critical to innovation.

Recent research has demonstrated the strong social and institutional basis of innovation and science and innovation policy should be concerned with facilitating the development of a facilitative social and institutional context. There is ample evidence that Australia's institutional environment and forms of economic organisation are deficient in terms of their capacity to stimulate learning and innovation (Parker 2004, 2006).

Submission 2: The report needs to engage more directly with an innovation systems framework in order to interpret the empirical evidence on which the report draws

3. An innovation systems framework: Shifting the emphasis from R&D, science and engineering to institutional environments and organisational learning

The report dismisses (rather than engages with) the massive and growing body of literature that adopts an innovation systems framework with a brief discussion on pp. 3.34-3.35. The main basis for rejecting this approach appears to be that it does not contain a 'welfare benchmark' against which to evaluate government expenditure. However, the objective of an innovation systems framework is to evaluate the institutional arrangements and forms of economic organisation that impact on innovation rather than to focus on levels of government funding. As such, the report needs to engage much more directly with the insights of this growing tradition of research.

The innovation systems approach emphasises innovation as a process of interactive learning between a firm and its environment, involving feedback mechanisms or loops, representing the complex interactions between a variety of institutions in the system as part of a continuous process involving incremental change, error and modification (Edquist 1997, p. 1-2). As such, the report needs to evaluate innovation policy in terms of its effect in stimulating these processes of learning and reflection between firms and their environment.

Submission 3: The report needs to identify the impact of policy on institutional environments and organisational learning processes as a basis for evaluating policy support for innovation

4. Reinterpreting the findings of the report through an innovation systems framework

The findings of the report can be more fully justified and understood with reference to an innovation systems framework rather than with reference to traditional economic models. An innovation systems framework emphasises interactive forms of economic organisation and organisational learning through reflexivity as important foundations for innovation.

Submission 4(a): A positive dimension of the report is its criticism of the strong and growing emphasis on narrow definitions of commercialisation in innovation policy

The report correctly highlights the importance of adopting broad definitions of commercialisation which encompass a wide variety of activities that contribution to knowledge transfer rather than focusing on narrow incidents of technology transfer to individual firms as the objective of innovation policy.

This finding (pp. 6.48-6.49) can be well justified in terms of an innovation systems framework. Innovation research has shown that innovation is not principally driven by a 'science push' model of R&D involving research in large firms or in universities which is pushed out into the economy (although this dimension of innovation is important). A substantial component of innovation involves decentralised forms of economic interaction that involve the sharing of ideas and the combination of different forms of knowledge (Edquist 1997).

The suggestion that CRC guidelines have become too focused on commercialisation with a subordination of social and environmental advantages (p. 9.42 – 9.43) is also an important finding in this context. As a large component of economic innovation does not fit with the 'science push' model, the growing commercialisation emphasis in CRC guidelines will limit the effectiveness of the program in stimulating innovation which does not involve intellectual property generation or spin-offs and is typically of broader social benefit. The commercialisation emphasis will also affect the type of industries which will likely be neglected in the CRC program, particularly the services sector in which collaboration is unlikely to result in spin-offs and is less likely to involve the generation of intellectual property rights but might involve improved business processes.

Submission 4(b): A positive dimension of the report is its acknowledgment of the importance of linkages between research organisations and groups of firms, although this should include an acknowledgement of the role of research organisations and intermediaries in the meta-governance of innovation networks

The report's acknowledgement of the importance of business linkages (p. 6.28) is highly consistent with an innovation systems approach. Suggestions to expand the CRC program (p. 9.53) to include multi-firm collaborative

proposals can be further justified on the grounds that it stimulates network forms of interaction between firms for the purpose of generating new knowledge; something we know to be important from the innovation systems literature. This might also result in the participation of a larger number of SMEs and remedy the existing bias of the CRC program towards very large players. However, the suggestion that such a program might not involve universities or research organisations requires some further thought because international experience suggests that networks of firms engaged in knowledge generation are typically coordinated by an independent player, whether it is a university/research organisation or an independent intermediary. A case can be made for the importance of having research organisations or knowledge intermediaries play a role in meta-governance of networks of firms involved in innovation activities (see Parker 2007 forthcoming) as these organisations have independence and their interests are aligned with the group rather than any individual participant. Further, as knowledge intermediaries and research organisations have strong familiarity with the processes of new knowledge generation they can offer expertise in governing interactive learning.

5. Limitations of the analysis in the report relating to SMEs

In regard to SMEs, the report suggests that a large proportion of SMEs are not technology intensive and as such may not depend on links with research organisations. However, this is inconsistent with the reports general finding that technology commercialisation alone should not be the key focus of interactions between research organisations and industry (see comments on commercialisation above). It may well be that there are poor linkages between research organisations and SMEs for the purpose of facilitating much broader dimensions of knowledge transfer including business know-how, management education, design, marketing and technological opportunities and inputs which appear to be important to innovation in the large proportion of SMEs particularly in services industries (the report acknowledges this point on p. 6.30 but loses the point by p. 6.32). Although the report makes the argument that other firms and customers might be more important sources of knowledge for SMEs than research organisations (p. 6.32), this does not mean there is no role for public policy in facilitating knowledge exchange between SMEs and their customers, suppliers or other institutions such as industry associations as explained above (4(b)).

The justification for policy intervention arises from the fact that we have strong evidence that SMEs in Australia are not embedded in the kinds of institutional structures that facilitating knowledge exchange, whether that exchange is occurring between SMEs or between SMEs and research organisations. As the report acknowledges, the Business, Industry, and Higher Education Collaboration Council (BIHECC) submission to the inquiry showed that Australian SMEs adopted new technologies to improve their business or develop new products at a substantially lower rate than in Europe and the US (p. 6.29). This finding does not arise from an over-emphasis on the transfer

of 'cutting edge' science or 'technology push' models as implied by the subsequent discussion in the report (p. 6.29). It instead arises from an empirical observation that there is an inadequate application of existing knowledge to improve organisational processes and the creation of new products and services amongst Australian SMEs. The use of existing technology and other forms of knowledge to improve products and processes is the foundation of innovation amongst low and medium technology firms and SMEs in the services sector, which accounts for a very large proportion of Australian firms. As such there is strong justification for policy intervention to improve and update knowledge amongst Australian SMEs. Small business policy has become a major focus of governments throughout the OECD and the report needs to engage more directly with international examples of policy support for innovation amongst SMEs.

Submission 5: The report needs to be based on a deeper understanding of the innovation processes of SMEs and the policy mechanisms that can support SME innovation

6. Limitations of the report's analysis relating to the role of intermediaries

The report contains some useful insights regarding the role of intermediaries (p. 6.33-6.34) in knowledge transfer. The report could have gone further in analysing the potential role of intermediaries and the importance of public policy support for intermediaries. It appears that the reason for this deficiency in the report is its adoption of traditional economic models that require public intervention to be justified in terms of market failure. As explained above (Submission 1), traditional economic models are insufficient in the analysis of innovation policy.

Submission 3 above captures the basis for evaluating innovation policy support in terms of its impact on institutional environments on organisational learning processes. This approach provides a firm basis for justifying public support for intermediaries. We have strong evidence that there are deficiencies in business innovation in Australia, particularly in relation to SMEs (Submission 5) and that this can in part be explained by particular forms of economic organisation in Australia in which firms have relatively weak connections with customers, suppliers, competitors and knowledge institutions (Parker 2005, 2006). As explained above (Submission 3), these interactive processes are critical for innovation and the weakness of inter-firm relations in Australia helps to explain the findings of surveys such as that reported in the BIHECC submission.

The justification for public support for intermediaries therefore arises from the need to foster interactive learning processes that are important for innovation comprising of networks of firms or firms and research organisations. The justification goes well beyond that associated with a narrow definition of technology commercialisation to including interactive learning activities and

broad forms of knowledge transfer involving seminars, conferences, workshops and education regarding management, marketing, design and technological inputs to processes and products.

Public support of this kind does not result in win-falls to individual firms, but results in the improvement of overall structures of learning and innovation in the economy which will have a long term impact. Individual firms cannot make the transition alone because it requires a change in behaviour amongst groups of economic actors and knowledge suppliers. Research shows that intermediaries can do more than produce one-off transfers of knowledge by creating an overall system of learning and problem solving within which the capacity for knowledge flow and the creation of new knowledge is improved (Bessant and Rush 1995:101). In addition, intermediaries can themselves directly contribute to new knowledge creation while performing their brokering function in cases where they "transform the ideas and knowledge being transferred …. to provide solutions that are new combinations of existing ideas to their clients" (Howells 2006: 716).

Submission 6(a). The report needs to develop a justification for public support for independent intermediaries on the grounds that intermediaries facilitate interactive learning and broad approaches to knowledge transfer (rather than narrow agendas of technology commercialisation)

As the report acknowledges, the role that intermediaries play in broad processes of knowledge transfer and the facilitation of interactive learning involves competencies and networks that the commercialisation arms of universities do not necessarily possess. Universities outside the large research intensive universities as well as industry associations and international industry forums have much to contribute to these broader definitions of knowledge transfer that go beyond science and technology push. Yet the report suggests that it is only the research intensive universities with strengths in science and engineering that are able to afford or sustain competitive dedicated commercialisation units (p. 6.53). A case can therefore be made for public support to knowledge intermediaries that are independent of universities. This also provides a stronger basis for legitimacy of these intermediaries because they will be able to transfer knowledge from all universities and knowledge suppliers whereas the research commercialisation arms of universities will have at least a perceived bias towards their own institution.

Submission 6(b). The report needs to develop a justification for independent intermediaries on the basis that they are able to draw on diverse forms of knowledge from a broad range of sources and not just the science and engineering faculties of research intensive universities

7. Innovation in services as well as science and engineer

The existence of a strong science and engineering sector and high levels of private R&D expenditure have been shown to be linked to economic competitiveness in the knowledge economy (Parker 2004). While resources booms provide short term advantages, they can divert attention from the need to develop high quality skills and competencies in developing industry sectors that provides the foundation for longer term industrial competitiveness. As such, it is important to respond to relatively low levels of R&D expenditure amongst Australia business and to acknowledge that the structure of Australia's industry is not necessarily appropriate to long term competitiveness. The promotion of knowledge intensive activities can build on existing strengths in Australia's mix of industries while providing a foundation for longer term industrial transformation.

Moving beyond science, engineering and R&D, it is also critical to analyse innovation in traditional industry sectors and in the services sector, which constitute a large proportion of Australia's economic activity. Prior research indicates that there are significant differences in the knowledge transfer and innovation process in different industry sectors and that business competitiveness depends on knowledge transfer and innovation in traditional as well as high technology sectors (Hirsch-Kreinsen et.al. 2005). More research is required on the service sector and the role of public policy needs to be analysed more broadly than has occurred on pp. 3.15-3.17. The discussion on the service sector is clouded by the over-emphasis on spillovers as the basis for understanding and interpreting the role of public policy in innovation.

Submission 7: the report needs to acknowledge the importance of developing an appropriate mix of high-skilled and innovative activities for economic competitiveness and the particular innovation problems that exist in different industry sectors

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