Inquiry into business commitment to R&D in Australia

A Submission to the Standing Committee on Science and Innovation of the House of Representatives

Australian Academy of Science

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Preamble

1. This submission reflects the agreed position of the relevant officers of the Australian Academy of Science.[1] It is based upon previous policy statements by the Academy and upon the conclusions derived from an analysis of relevant data, information and documentation. It will not formally reflect the view of the Australian Academy of Science until the document has been ratified by the Academy's *Executive Committee*. This will take place at a later date and the ratified version, suitably marked, will be placed on the Academy's web site. Material that may not necessarily reflect the agreed views of the Academy's *Executive Committee* but which is relevant to the issue at hand is placed in an Annex to the submission with appropriate attribution of authorship.

Introduction

2. The Australian Academy of Science welcomes this inquiry by the *Standing Committee on Science and Innovation* into business commitment to R&D in Australia. Our submission highlights the benefits of introducing a more explicit treatment of the investment risks associated with conducting R&D into the operation of the R&D Tax Concession. The suggested approach is designed to help small and medium sized enterprises (SMEs) to increase their investment in R&D via more effective investment risk management. The Academy also highlights the benefits of a move towards a more active consideration of investment risk management issues *within* the public sector.

3. The Academy welcomes and endorses the decision not to implement the proposal that R&D projects should demonstrate *both* innovativeness *and* a high level of technical risk in order to be eligible to receive the R&D Tax Concession. The continuation of the existing policy of requiring an appreciable element of novelty *or* high technical risk is, in our view, beneficial because it facilitates the lower risk incremental approaches to innovation that are likely to contribute to sustainable increases in business R&D investment. The decision to continue with the existing

[1] These officers are: Professor Michael Barber (Secretary – Science Policy), Professor Sue Serjeantson (Executive Secretary). These officers received advice on this submission from Dr Mark Matthews (Science Policy Advisor to the Australian Academy of Science).

policy was therefore very useful. The Academy recognises, however, that one intent of the original draft proposition requiring both innovativeness and a high level of technical risk to be present may have been to limit claims from large companies for investments that they would have made anyway without the benefit of the R&D Tax Concession (as is evident in examining the various appeals and judgements that comprise case law in this area). Consequently, we propose a modification to the implementation of the legislation that is designed to provide a more 'evidence based' basis for case law regarding eligibility to receive the R&D Tax Concession. The suggested approach should also facilitate sustainable increases in R&D investment by SMEs.

4. The issue we highlight is the need to base government support for business R&D on the pragmatic consideration of the capacity to manage (i.e. learn to *minimise*) *investment risks* associated with R&D. Whilst moving into higher value-added markets does involve taking on new and often higher, investment risks associated with R&D, those companies that succeed will tend to do so because they learn how to move into new markets or market niches by taking lower rather than higher investment risks. Policy should therefore aim to encourage lower investment risk approaches to innovation, and the treatment of the relationship between innovation and technical risk should therefore be augmented by a consideration of the anticipated *investment risks* faced and their implications for whether the R&D investment would take place without the benefit of the R&D Tax Concession.

Why business commitment to R&D is a concern for the Academy

5. The level of scientific and technological (S&T) capabilities possessed by the business sector play a critical role in facilitating the transfer of technology from universities and government research agencies. This is because these S&T capabilities affect: (a) the business sector's receptiveness to innovative new approaches; (b) its ability to assimilate new knowledge and techniques, and; (c) to develop and introduce these concepts into the market place.

6. The level of business S&T capabilities also influences the strength of the 'symbiotic' relationship between private sector and public sector R&D. Firstly, the extent to which business' innovation challenges also constitute challenges for leading edge academic research is a major influence on the strength of this symbiotic relationship in terms of shared research objectives and knowledge exchange. Secondly, the business sector's capacity to use its links with Australian academics to access global science networks also requires comparable levels of S&T capabilities. Technologically advanced companies fund university-based research partly with the explicit objective of gaining "...*access to a wide body of expertise which can be particularly valuable when responding to unforseen events and in alerting them to breakthrough discoveries and to competitor's research strategies*."[2] This point was highlighted in Professor Michael Barber's recent Telstra address on national research priorities.[3]

7. For companies that are defining the S&T frontier in their industry the risk that a competitor will achieve a fundamental breakthrough (possibly via research collaboration with academia) is viewed as a major business risk.[4] Such companies view their investment in academic research as *the* key means of reducing this risk by helping them to avoid being unaware of potential threats to the companies' market value and allowing them to put in place appropriate defensive tactics. In some companies the value of this aspect outweighs the anticipated benefits from the

[2] Universities UK, Patent Office and AURIL (2002) '*Managing Intellectual Property: A Guide to Strategic Decision Making in Universities*'., Chapter 3 'Ownership of IP and negotiations with Sponsors', page 54. Available at: http://www.patent.gov.uk/about/notices/manip/index.htm

[3] Research Priorities for Australia: Setting Our Future. Telstra Address, 26 June 2002. Available at: http://www.science.org.au/academy/media/26June02.htm

[4] Whole areas of technological capability and associated intellectual property portfolios can be reduced in value overnight due to changed expectations of the future stream of revenue they will generate.

specific research projects they fund. Thus, imbalances in business – academic S&T capabilities limit Australian companies' capacity to leverage global R&D investment via international academic networks, and maintain the company's market value in the face of possible S&T breakthroughs thus reducing the productivity of their R&D investments.[5]

8. Weaknesses in business sector S&T capabilities therefore reduce the nation's overall 'social rate of return' on public sector R&D investment because they limit this symbiotic relationship. This, in turn, makes it more difficult to justify any further increases in public sector R&D investment (such as in adequate research infrastructure funding). The resulting low intensity of our overall R&D investment (known as GERD[6]), largely due to low business sector R&D investment (BERD), traps Australia in relatively low value added export activity. This low value-added emphasis increases our sensitivity to price volatility and long-term downward trends in commodity prices – thus endangering Australia's economic security.

9. The level of business commitment to R&D investment is a major determinant of business S&T capabilities (other major factors are the level of investment in *informed* technology acquisition). Without significant increases in BERD our ability to move into higher value added markets and build emerging industries will be limited. Consequently, addressing concerns over the level of business commitment to R&D investment is a matter of national concern.

The Academy's previous recommendations

10. In its statement on 'Priorities in research and innovation for the next Australian government' issued in 2001 the Academy recommended that:

    - Any indicative trends of unwelcome outcomes in business investment in R&D must be spotted quickly and responded to promptly. The next Australian government must state its preparedness to fine-tune taxation incentives in the light of experience (recommendation 6).

11. The context to recommendation 6 concerning tax subsidy-based incentives was the proposal that R&D projects should demonstrate *both* innovativeness and a high level of technical risk in order to be eligible to receive the R&D Tax Concession.[7] The Academy highlighted the problem that this definition may exclude investment aimed at achieving some types of incremental technical change in products and processes. Many companies innovate effectively by making a series of small incremental improvements in their products and processes and achieve this precisely because an incremental approach reduces technical risk (and hence their investment risks) when compared to 'big push' projects. This point applies in particular to the information and communication technology area and other technologies that involve highly complex inter-dependent systems in which innovation is best carried out via many small 'evolutionary' steps. It applies also when innovating by adapting existing plant (a process known as 'retrofit' technical change).

12. Although this specific issue is no longer a concern because the proposal was never implemented, the Academy's more general point about the relationship between

[5] See Matthews, M L (2002) 'Providing the Machinery of Science', Discussion Paper, Australian Academy of Science, for an account of the policy benefits of leveraging global R&D investment. Available at: http://www.science.org.au/academy/media/machinery.pdf

[6] Gross domestic expenditure on R&D.

[7] This would have aligned the definition of R&D used in order to determine eligibility to receive the R&D Tax Concession more closely with the definition of R&D provided in the OECD's Frascati guidelines, which state that: "(T)he basic criterion for distinguishing R&D from related activities is the presence in R&D of an appreciable element of novelty and the resolution of scientific and/or technological uncertainty, i.e. when the solution to a problem is not readily apparent to someone familiar with the basic stock of commonly used knowledge and techniques in the area concerned" (paragraph 79 of 1993 Frascati Manual).

innovativeness and risk-taking still has currency. This is because R&D investments depend partly upon perception of the *investment risks* faced as a consequence of the degree of innovation, technical risks *and* expenditure levels required. Increased R&D investment can therefore be facilitated by lower uncertainty over the overall investment risks faced (e.g. being more certain what the project will actually cost to complete). The existence of innovativeness and/or high technical risk imply high investment risk - particularly when both conditions exist. However, the decision as to whether or not to proceed with the R&D investment also depends upon the level of uncertainty over the expenditures required to achieve these objectives. A more accurate forecast of these expenditures (i.e. lower investment risks) will facilitate increased R&D investment. At present the technical risk based component of these wider investment risks are not considered in the implementation of the legislation over the R&D Tax Concession. The Academy believes that an explicit consideration of the investment risk dimension (as part of the new requirement to prepare *R&D Plans*) would improve the effectiveness of the tax subsidy and help to limit inappropriate claims for the tax concession. The following section discusses this point in greater detail.

13. The Academy Priority statement referred to above also recommended that

    - The next Australian government should consider implementing a formal offset program when giving assistance to major industrial developments (recommendation 7).

14. The rationale behind this recommendation is that a formal offset program focused on building R&D capabilities in the business sector could play a useful role in facilitating business sector R&D. The technology transfer processes involved in a formal offset program are a cost-effective means of leveraging global R&D investment – but a clear strategy of seeking to acquire leading or near leading-edge S&T from overseas is required in order to make this technology transfer happen. If a requirement for technology transfer (usually linked to domestic R&D aimed at customising and refining a core technology) is not sought in negotiations over major industrial developments then it is unlikely to be offered as part of the deal.

What more could be done to increase business R&D investment?

Prioritising the investment risk dimension

15. As discussed above, R&D investment involves taking technical and commercial risks. Striving to compete in higher value added markets involves taking on greater investment risks. Unless companies, and SMEs in particular, possess the capabilities to manage these increased investment risks, then they may be rational *not* to increase their R&D investment. Indeed, the lower investment risk strategy is more likely to allow an R&D investment to go ahead in the first place, particularly if a formal investment appraisal process if followed.[8] The commercial risks faced by that company given its own capacity to manage more complex investment risks mean that it would be foolhardy to start investing in R&D or to significantly increase its R&D investment.

16. Government programs that subsidise and facilitate business R&D investment (the suspended R&D START grants and loans, R&D Tax Concession, COMET etc) are intended to assist companies to improve their capacity to manage the investment

[8] Higher risks are reflected either in an increased discount rate used to estimate the 'net present value' (NPV) of the investment or are handled explicitly by generating an '*expected* net present value' estimate that incorporates the various investment risks faced into cost and benefit scenarios. In both approaches, a higher investment risk approach will reduce the estimated NPV of the investment option – thus making it less likely to go ahead. Even if formal NPVs are not estimated (NPVs are rarer for R&D investments than for other projects due to the added difficulty of incorporating risks into NPV estimates) the same principles still apply to more subjectively based decisions.

risks associated with increased R&D investment by offsetting the commercial risks they face. This is why the COMET program, in principle, could play an important role in stimulating SME's R&D investment by providing more direct assistance in this area. The difficulty with programs such as COMET is that the people with appropriate expertise may not be available in Australia.

17. One potential design problem with such programs is that offsetting these commercial risks does not necessarily improve companies' capacity to manage R&D related investment risks better in the future. The well-known negative side-effect is when the government R&D subsidy simply lowers the investment risk threshold by virtue of requiring a lower level of company funding for the project. This can result in a failure to manage and learn from the investment risks faced simply because the R&D project is not of major concern to the company because the investment risk 'exposure' is low. Such situations can result in the company improving its capacity to manage investment risks in R&D but this is by no means certain.

18. SMEs in particular face severe difficulties in investing in R&D not because they are unaware of the long-term commercial benefits, but because they simply do not have the management experience to handle the new types of investment risk involved – and they know this. These are the management capacities to:

- accurately identify and appraise possible investment risk factors;
- develop investment risk mitigation strategies and tactics;
- build these investment risk mitigation approaches into R&D project plans;
- actually execute R&D projects in a way that allows investment risks to be minimised;
- learn from experience in such a way that future R&D projects are more likely to face lower investment risks than would otherwise be the case (by understanding how and why things went wrong in the past and retaining this is 'corporate memory').

19. It is noteworthy that it is now a requirement that an R&D Plan be prepared in order to be eligible for claiming the R&D tax concession[9] but that the recommended content of these R&D Plans does not address the very investment risk issues that constrain real business decisions over whether or not to fund an R&D project and over how to carry out the project such that investment risks are minimised. As a result, these R&D plans are unlikely to encourage effective investment risk management relating to R&D – the very thing that is required in order to release business investment.

20. It would therefore be worth considering modifying the required format of R&D Plans in order to encourage companies to deal explicitly with the investment risks they will face and how they intend to deal with them. Annex A discusses this issue on a technical level. As a first step, the Standing Committee on Science and Innovation into Business Commitment to R&D in Australia might wish to solicit information from the IR&D Board on why a decision was made *not* to cover the technical risks faced in projects in R&D Plans and their implication for investment risks - the IR&D Board may have sound reasons for avoiding this issue that the Academy is unaware of.

21. On a more general level, the implication of our argument is that a policy framework that treats the development of the capacity to minimise investment risks in R&D as a key objective is more likely to increase business commitment to R&D investment than simply exhorting company boards to invest more in R&D.

22. We also take this opportunity to highlight the ways in which Australia's growing cohort of science based spin-off companies that have experienced high investment risks are a national resource of investment risk management expertise. This cohort of companies not only provides useful exemplars and case studies of how the

[9] See http://www.ausindustry.gov.au/library/RandDPlans20020305103857.rtf for guidelines on these R&D Plans.

investment risks associated with high value added business can be managed (or mismanaged), their staff also possess highly valuable knowledge on how to actually manage these high investment risks better in the future. Some of these start-ups in biotechnology, ICT and photonics, are, at this point in difficulty and there may be a crisis in public confidence as some of these companies burn out over the next 12 months.

23. Spin-off and start-up companies provide an industrial constituency that will, in the future, be more receptive to, and be able to assimilate the S&T advances that emerge from, our universities and public sector research organisations. [10] Failures in the process of creating this high-tech constituency are inevitable given the high risks involved. However, the experience gained in managing these high investment risks has tremendous social value. In the long term, this experience will help to improve the social return on public sector investment in R&D in Australia. This is provided that government accepts that failures are inevitable and seeks to prevent a 'backlash' against these attempts to transform Australia's industrial landscape via a move into high value added – high investment risk activities. An emphasis on investment risk management issues will help to prevent such a backlash (not least from policy-makers who may under-estimate the importance of the investment risk management challenges faced).

Towards a whole-of-government approach

24. The Academy also wishes to highlight the benefits to the business sector of placing a greater emphasis on a whole-of-government 'investment risk aware' approach to policies towards science, investment attraction and industry assistance.[11] We have already highlighted the advantages of considering S&T capability acquisition issues in negotiating offset arrangements for major industrial developments (thus helping our companies to acquire leading edge technologies). The more general point is that there are a number of policy areas in which greater clarity in government's forward strategy, coupled with a whole-of-government approach to implementing such a strategy, are likely to generate major national benefits. Our defence capabilities, capacity to actually deliver solutions for problems addressed in our national research priorities and our general ability to grow emerging industries *all* rest upon improving business sector scientific, technological, management *and* marketing expertise. There is rarely a purely scientific and technological 'fix' for these problems in the business sector – the trick is to integrate diverse areas of knowledge.

25. The Academy has already highlighted concerns that the useful contribution of the CRC program may be constrained if CRC selection criteria "*..prejudice the development of CRCs in key areas in which current Australian industry participation is weak. CRCs have a role in developing emergent industries. The Australian Photonics CRC is an excellent example of a CRC that has promoted an emergent Australian industry and, in the process, generated several SMEs."*[12] An over reliance on the existence of industry partners would limit the effectiveness of this program and hence its ability to stimulate new emerging industries in Australia. A whole-of-government approach would provide a means of ensuring that program-specific investment selection criteria align with a forward strategy for Australian economic development, and consequently avoid such problems.

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[10] As discussed in Johnston et al '*Enabling the virtuous cycle: identifying and removing barriers to entrepreneurial activity by health and medical researchers in the higher education sector*' (2000). Evaluations and Investigations Programme Report no. 00/14. Available at: http://www.dest.gov.au/highered/eippubs/eip00_14/00_14.pdf

[11] The Academy wishes to acknowledge the contribution of Geoff White, Director, SQW Ltd and Special Advisor to the UK Secretary of State for Trade and Industry to the ideas on risk management in the public sector drawn upon in this submission.

[12] Point 5 in the Academy's submission to 'Options for the CRC Program'. 2001.

26. Similarly, government service delivery *itself* cannot rely upon a technological fix. Greater coordination of policy objectives involving the integration of scientific, managerial, economic and policy knowledge across portfolios will help to generate innovative policy solutions. The challenges of dealing with uncertainty over climate change, solutions to environmental degradation, national security post September 11th and many other issues all require approaches that integrate the scientific and the non-scientific together with the activities of different government departments. Responding to these challenges involves innovation and risk-taking within government itself (partnership building between departments and the integration of knowledge from different disciplines are all higher risk activities). Thus, our points about the risk management challenges involved in innovation in the business sector also apply to the public sector. Calculated risks need to be taken under conditions of uncertainty within government. Our success in rising to these future challenges will rest partly upon our public sector investment risk management capabilities. This focus on public sector investment risk management, in turn, helps to create a more productive dialogue between the public and private sectors because the concepts, methods and values in both sectors begin to converge rather than remain distinct.

27. Other governments are now addressing this issue. For example, the UK government has given explicit recognition to the need to provide a form of 'venture capital' in order to stimulate innovation, risk taking and partnership building *within* the public sector in order to modernise government policy formulation and service delivery.[13] The UK experience demonstrates that the investment risk management challenges for the public and private sectors are very similar. Providing finance alone may not be sufficient because the process also requires the active management of the investment risks involved when attempting to innovate within a risk-averse culture.[14] Such initiatives provide increased scope for the sharing of ideas and experiences in investment risk management between the private and public sectors. Indeed, the lack of attention paid to risk management issues that we have identified in relation to the R&D tax concessions may simply be a symptom of lack of familiarity with such risk management issues amongst Australian public servants.

28. The Academy would be happy to expand upon this investment risk management based perspective towards business commitment to R&D, and its links to public policy development, if this would be of assistance to the inquiry.

[13] Via the HM Treasury and Cabinet Office 'Invest to Save Budget'.

[14] SQW Ltd (Forthcoming 2002) '*Programme Evaluation of the Invest to Save Budget'*, Report for HM Treasury and the Cabinet Office. See http://www.isb.gov.uk/ for details of the ISB programme.

Annex A: Handling uncertainty and investment risk when attempting to innovate[15]

29. The existence of technical risk associated with R&D are defined in section 73B(2B) of the *Income Tax Assessment Act 1936* (ITAA 1936) and via subsequent amendments as that:

    (i) the probability of obtaining the technical or scientific outcome of the activities cannot be known or determined in advance on the basis of current knowledge or experience; and,

    (ii) the uncertainty of obtaining the outcome can be removed only through a program of systematic, investigative and experimental activities in which scientific method has been applied, in a systematic progression of work (based on principles of physical, biological, chemical, medical, engineering or computer sciences) from hypotheses to experiment, observation and evaluation, followed by logical conclusions.

30. The IR&D Board has recently re-iterated that, in practice, an activity will be deemed to be R&D for the purposes of the R&D Tax Concession if a project has the following main elements: [16]

    - identification of a problem with significant technical uncertainty that cannot be resolved on the basis of publicly available knowledge in that particular field of technology;
    - originality in the generation of new or different ideas or concepts leading to possible solutions to the problem; and.
    - a program of experimentation including testing or trials for the purpose of discovering something unknown, or testing a principle or proposed solution to the technical uncertainty.

31. Much therefore rests upon the case-by-case interpretation of any trade-offs between these three criteria. Technical uncertainty is deemed exist when the 'probability of obtaining a desired outcome cannot be known or determined in advance' *and* when this uncertainty can only be removed via systematic scientific activities.

32. An examination of case law surrounding appeals over eligibility for the R&D Tax Concession highlights the tendency for large companies to seek to treat major investments as R&D suitable for receiving the tax concession and for the IR&D Board to seek to block these claims on the basis that the degree of innovation or the level of technical risk involved are insufficient.[17] The high cost of such investments (hence large potential cost savings), combined with the existence of professional advisors with specialist knowledge of the relevant areas of legislation able to base their fees on the cost savings they generate are likely to be a potent combination driving large claims for the R&D Tax Concession. There is inevitably a concern that the complexity of the issues and the uncertainty that surrounds eligibility for the tax concession (evident in the case law) may limit the take-up by SMEs.

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[15] This Annex was prepared by Mark Matthews, Science Policy Advisor, Australian Academy of Science.

[16] AusIndustry, DITR & Commonwealth Government of Australia. 'Tax Concession for Research & Development', April 2002. Available at: http://www.ausindustry.gov.au/library/12PageBroc20020607102404.rtf

[17] See: Mobil Oil Australia Ltd v IR&D Board (1995) 30 ATR 1364; 95 ATC 2041, AAT Case 10,193; IR&D Board v Unisys Information Services Australia Pty Ltd (1997) 37 ATR 76, 97 ATC 4848.

33. More fundamentally, potential policy problems emerge because a well managed company that makes prudent investments involving taking *calculated* investment risks *will* seek to estimate the probability of obtaining a desired outcome in advance in order to appraise the investment opportunity – particularly if it bases its decisions on formal estimates of the 'net present value' of different investment options. Indeed, it will seek to improve the accuracy of these estimates of the probability of success over time via its experience of different R&D projects. The greater the accuracy of its forecasts of technical and investment risk the more likely it is to fund R&D projects of higher value and/or at times of low business confidence.[18]

34. There is therefore a fundamental problem in the way in which the legislation defines technical risk in the business context.[19] This problem is recognised in the case law surrounding eligibility for the R&D Tax Concession. As the Federal Court judgement in IR&D v UNISYS Information Services Australia Pty Ltd stated: "*Counsel for the respondent submitted that in considering 'technical risk' one should decide whether there is a realistic likelihood of the work failing altogether… the agreed interpretation to be found in Mobil Oil Australia Ltd makes no reference to it*. *A mere uncertainty as to outcome is all that is required. If the present submission were to be accepted, it would result in the section having almost no scope for positive operation. Few commercially responsible companies would decide to invest resources in projects where there was a realistic likelihood of the work failing altogether*." (Administrative Appeals Tribunal judgement on IR&D Board v UNISYS Information Services Australia Pty Ltd, 1997).

35. It is for this reason that the established policy is, in practice, to determine that there is "….*no technical risk in a given activity unless either there is reasonable uncertainty over what the results will be or there is reasonable certainty over the general results, but reasonable uncertainty over which of the several alternatives is technically feasible, meets a desired technical specification, or meets a desired cost target."* (Administrative Appeals Tribunal judgement on IR&D Board v UNISYS Information Services Australia Pty Ltd, 1997).

36. One way forward would be to make it a requirement in *R&D Plans* that the technical risk factors and risk mitigation strategies be specified, with a recommendation (but not requirement) that an outline formal investment appraisal estimate be provided that incorporates these technical (and other) risk factors.

37. The option to quantify investment risks via a formal investment appraisal would provide a useful basis for determining eligibility in appeals. This is because the probability of success and associated uncertainties would be explicitly reflected in the investment appraisal estimate – and would have the effect of reducing the 'net present value' (NPV) of the project using textbook techniques. The existence of such estimates would therefore provide a sound basis for examining whether of not claiming the R&D Tax Concession is likely to tip the balance in favour of actually investing in the project because this too could be demonstrated in the NPV estimates.[20] This would avoid repeated recourse to dictionary definitions of 'risk', 'uncertainty' and 'innovation' that dominate judgements in the current case law over the R&D Tax Concession. Case law build upon a series of judgements over the *quantified* investment risks faced in each case is likely to be a more useful basis for delivering effective policy.

38. Such a requirement (which could be facilitated by the IR&D Board providing an Excel template for carrying out such NPV estimates and associated guidance) would, in turn, help SMEs to manage their investment risks associated with R&D. This could

[18] Given that the bulk of business R&D investments are made from retained profits, forecasts of business cycle behaviour play a key role in driving business R&D investment.

[19] The OECD's Frascati Manual prefers to stress the notion of an 'appreciable element of technical uncertainty' rather than an inability to be able to assign a probability to the intended outcome.

[20] Estimates demonstrating how claiming the R&D Tax Concession tips the balance in favour of a project go-ahead would of course provide a rich source of data for justifying the net social benefits of the R&D Tax Concession.

help to reduce the incidence of business failures due to under-estimating the investment risks being taken, i.e. 'optimism bias'. Large companies are already familiar with the need to carry out formal investment appraisals of this type. Indeed, it is almost certain that the investment projects over which appeals take place involving large companies did require a formal investment appraisal to be carried out in order for authorisation to proceed to be granted.

39. An additional benefit of this approach would therefore be to provide the option to limit any 'corporate welfare' aspect of the R&D Tax Concession, i.e. any cases in which the R&D investment would in fact have gone ahead without the tax concession. This issue could, in principle, the addressed via considering (and if necessary challenging) formal investment appraisal estimates that make the impact of the tax concession on the investment go ahead decision explicit. Formal (risked) NPV estimates demonstrating the impact of the tax concession could be requested by the IR&D Board in cases in which eligibility to receive the tax concession is questioned. This would help to limit the extent to which the R&D Tax Concession simply substitutes public sector investment (in the form of tax revenue foregone) for private sector investment.

40. This approach should increase the likelihood that the R&D tax concession will generate *sustainable* increases in business commitment to R&D because the investment risks faced may decrease over time due to better management of the risks involved in the R&D process. This decrease in investment risk being based upon the ability to estimate the probability of technical success of the project – the very factor that (in principle but not practice) excludes a project from the definition of R&D under the current legislation.

41. Such an approach could allow the R&D tax concession to facilitate R&D in which very small innovative steps are attempted via relatively low levels of investment risk – but levels that would still be too high without the Tax Concession. In order for this to take place the IR&D Board would however need to modify its eligibility criteria to explicitly recognise the impact of the tax concession on the investment go ahead decision given the investment risks faced. This would, in turn, necessitate that there is a low level of ambiguity (hence uncertainty) over whether a claim for the tax concession will be knocked back after expenditures have been incurred. The inclusion of statements on risk factors and the option to provide NPV estimates would be a powerful mechanism for reducing the current level of uncertainty over what does and what does not constitute R&D eligible for the tax concession because the IR&D Board could set clear quantitative thresholds. This will be a particular benefit to SMEs – the class of firms for whom the R&D tax concession is of the greatest potential relevance given their limited financial resources.

42. In the long-run it may be preferable to change the wording of the *Income Tax Assessment Act* to something along the following lines in order to avoid the root cause of ambiguity over eligibility for the R&D Tax Concession (and of what does and does not constitute R&D) [21]:

    (i) Whilst it may be possible to estimate the probability of obtaining the technical or scientific outcome on the basis of current knowledge and experience this probability is sufficiently low that the investment is unlikely go ahead without the benefit of a special tax treatment for the investment; and,

[21] The current definition used in the tax legislation is in this respect more appropriate to basic research carried out in the public sector. Although even in this case the emphasis in ARC and NHMRC funding programs is increasingly on the likelihood of delivering planned research outcomes (i.e. knowing that there is a high probability of achieving the stated outcomes). Thus, even funding basic research would seem to be excluded from the definition of technical risk in the tax legislation.

(ii) the uncertainty of obtaining the outcome can be removed only through a program of systematic, investigative and experimental activities in which scientific method has been applied, in a systematic progression of work (based on principles of physical, biological, chemical, medical, engineering or computer sciences) from hypotheses to experiment, observation and evaluation, followed by logical conclusions.