

## CHAPTER 3: THE TYPE OF R&D UNDERTAKEN

3.1 The inquiry's terms of reference require the Committee to report on the effect of public policy changes over the last ten years, in the areas of corporatisation, privatisation, outsourcing and competition policy reform, on matters including:

- the nature of the R&D being undertaken (that is, basic or applied);
- the relevance of the R&D to the commercial needs of industry; and
- the level of investment in research infrastructure and equipment.

3.2 Those matters are examined in this chapter.

### The role of basic research

3.3 Basic, strategic and applied research are defined at page 1 of this report. The following more expansive definitions are sourced from the ABS and were used by the Industry Commission for its 1995 R&D inquiry:

- *pure basic research* is experimental and theoretical work undertaken without looking for long-term benefits other than the advancement of knowledge;
- *strategic basic research* is experimental and theoretical work undertaken to acquire knowledge directed towards specified broad areas in the expectation of useful discoveries. It provides the base of knowledge necessary for the practical solution of recognised problems;
- *applied research* is original work undertaken to acquire knowledge with a specific application in view. It is undertaken to find possible uses for the findings of basic research or to identify new ways of achieving some specific and predetermined objectives; and
- *experimental development* is systematic work using existing knowledge gained from research or practical experience, and is directed to producing new materials, products or devices, installing new processes, systems or services, or improving substantially those already produced or installed.<sup>137</sup>

3.4 Australia has historically had a high ratio of basic to applied research, reflecting the unusually high proportion of our R&D undertaken in the public sector. In 1996-97, more than 60 percent of Australia's R&D effort could be described as either basic (26 percent) or applied (35 percent) research. The remaining 39 percent was experimental development. Basic research comprises pure basic research (11 percent) and strategic basic research (15 percent).<sup>138</sup> The Industry Commission found that in the decade to 1995 there was a perceptible shift from research to experimental development, thanks to the rapid growth (from a low base) in BERD.<sup>139</sup>

3.5 In 1996-97 the higher education sector performed 82 percent of Australia's pure basic research. Government science agencies performed 38 percent of strategic basic research and 40 percent of applied research. Business enterprises carried out 87 percent of experimental development but performed only three percent of Australia's pure basic research.<sup>140</sup>

*Of the research that is undertaken by business, it is generally of an applied nature and product/process specific. By contrast, very little pre-competitive, generic type research is carried out individually by companies. This is because the private incentive to carry out such research is weakened through those carrying it out not being able to appropriate enough of the benefits for it to be privately profitable. The closer the innovation activities are to the market, the greater is the likelihood that the benefits arising from those activities can be captured by the firm concerned.*<sup>141</sup>

3.6 According to the 1999-00 *Science and Technology Budget Statement*, Australia increased its effort in basic research from 0.33 percent of GDP in 1978-79 to 0.44 percent in 1996-97. This compares favourably with other countries on the limited statistics that are available.<sup>142</sup>

3.7 As explained by the Industry Commission, the economic role of basic research is not directly to generate commercial products, but rather:

*...to provide essential support for, and raise the return on, more applied R&D. This is a much more diffuse role, but also a critically important one in successful innovation. It occurs through:*

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138 ABS, *Research and Experimental Development, All Sector Summary, 1996-97* (Cat. No. 8112.0), 1998, p. 10.

139 Industry Commission, *Research and Development*, pp. 107-109.

140 ABS, Cat. No. 8112.0, p. 10.

141 Industry Commission, *Research and Development*, p. 521.

142 Senator the Hon Nick Minchin, *Science and Technology Budget Statement 1999-2000*, p. 4.6 & p. 4.10.

- *training researchers, many of whom will work for industry or government;*
- *creating a store of ‘background knowledge’ which improves the effectiveness of technological search activities;*
- *enabling membership of ‘networks’ yielding access to the large body of knowledge generated worldwide; and*
- *developing new research techniques and instrumentation.*<sup>143</sup>

3.8 Several participants in the inquiry cautioned that a focus on outcome-driven R&D should not obscure the importance of basic research.<sup>144</sup> Speaking on behalf of the Australian Academy of Science, Sir Gustav Nossal told the Committee that:

*... these clarion calls for ‘more relevance in research’, ‘more application’, ‘more short-term tactical research’, which the Academy has backed and of which the Academy has been a part, are now in danger of going a bit too far. My contention is that the science base of the nation needs constant nurturing and cannot be pushed to one side with the attitude, ‘Oh well, we’ve done that, we’ve done the ‘R’; its time now to concentrate on the ‘D’.’ Other nations are not standing still. The cutting edge of basic science, which is the crucible from which all of the applied discoveries flow, must require constant nurturing.*<sup>145</sup>

143 Industry Commission, *Research and Development*, p. 5. Mr Michael Rice submitted in response: “I challenge the Industry Commission’s statement that many of the researchers trained in basic research will work for industry. The great majority of researchers in industry are graduates with bachelor degrees only”. Mr Michael Rice, submission no. 50, p. 3.

144 The RMIT, while not taking issue *per se* with this statement, cautioned that “...it is dangerous when it may be used to argue for swinging funding back from outcome-driven research to basic research. Basic research is underfunded but outcome-driven research is even more so”. RMIT, submission no. 24.1. Mr George Poropat submitted that “...the traditional focus in Australia on ‘pure science’ effectively denigrates the engineering which is essential to the delivery of science to the community”. Mr George Poropat, submission no. 17, p. 4. Mr Michael Rice submitted that “some of the evidence quoted...appears to be predicated on the assumption that the linear model of innovation (basic research-applied research-development-innovation) holds true. It is now widely acknowledged that this simplistic model does not bear any relationship to reality”. Mr Michael Rice, submission no. 50, p. 2. See also pages 49 and 73 of this report.

145 Sir Gustav Nossal, Australian Academy of Science, transcript of evidence, p. 37. See also Australian Academy of Science, “Innovate or Perish – Academy of Science President Calls for Government Leadership to Lift Australia’s Game” (media release), 29 April 1999 at <http://www.science.org.au/academy/media/perish.htm> (as at 10 July 1999).

3.9 FASTS observed that:

*It is fine to have industry driven research but it is hard to see an industry or an industry committee that would turn around to a bunch of researchers and say, 'Look fellas, go off and invent a laser or a transistor.' It just does not work that way. Industries can exploit those developments from basic research but they cannot necessarily perceive them; in fact, it took many years for those applications to emerge.<sup>146</sup>*

3.10 The AVCC further cautioned that the imposition by governments and grant-giving agencies of "...rigid priority structures with inflexible reporting timelines" is inappropriate for basic research and stultifies innovation.<sup>147</sup>

3.11 Without denigrating the importance of outcome-driven research, ongoing government support is needed for basic, curiosity-driven research, which in turn has certain implications for funding of universities and public sector research agencies. Matters relating to the university research system (include the ongoing debate about the balance between basic and outcome-driven research) are examined in Chapter 4.

3.12 Further to the comments at page 41, it should be noted that the CRC program, while rightly praised, could not compensate for neglect of the basic research base. The Academy of Technological Sciences and Engineering noted that the program encourages medium-term R&D but "does not provide the solution for funding of research of a longer term strategic nature".<sup>148</sup> The University of NSW commented that:

*the funds allocated to [the CRCs] are primarily expended in applied R&D. Whilst the desirable cultural changes that have been brought about by the CRC program must be applauded, there is a very real fear that insufficient basic research is being done to sustain the technological leadership of Australia in a number of areas. The research being performed in key infrastructure areas like energy production, water and wastewater treatment and transport is now very short term in nature.<sup>149</sup>*

3.13 The Committee notes the RMIT's caution against equating "outcome-driven" research with "short-term" research in this context.<sup>150</sup>

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146 Professor Peter Cullen, FASTS, transcript of evidence, p. 69. See also FASTS, *A Science Policy for Australia in the 21<sup>st</sup> Century*, p. 7.

147 AVCC, submission no. 49, pp. 5-6.

148 Academy of Technological Sciences and Engineering, submission no. 30, p. 5.

149 UNSW, submission no. 33.

150 RMIT, submission no. 24.1.

## The effect of policy changes on the *type* of R&D

3.14 As with other aspects of the inquiry, attempts to identify the effects of public policy changes on the *type* of R&D conducted are complicated by several factors.

3.15 One factor is the increasing difficulty of making distinctions between the different types of R&D.<sup>151</sup> The University of Western Sydney stated that:

*...it is less and less easy and useful to try to separate pure and applied research. In many areas of scientific inquiry, especially those relating to the core technologies of communications, basic and applied research are intertwined and emerge at different stages of the same process. If R&D levels are affected at all therefore both basic and applied research are likely to be affected...*<sup>152</sup>

3.16 AMIRA observed that in the minerals industry:

*... outcome-driven inquiry inevitably stimulates more fundamental understanding of the problems. It is a complex, interactive relationship which is definitely not linear as implied by the way these figures are normally presented (i.e. basic → strategic → applied → commercialisation).*<sup>153</sup>

3.17 Telstra added that attempts to describe R&D as “long-term” versus “short-term” have become virtually meaningless – for example, “short-term” research in the telephone network will equate to very “long-term” research in the Internet.<sup>154</sup>

3.18 A second factor is that some of the changes in R&D during the decade under review would have occurred anyway, thanks to technological changes and shifts in the international business environment.<sup>155</sup> Overseas business R&D has also moved towards more short-term innovative efforts, as DPIE noted:

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151 See Mr George V Poropat, submission no. 17, p. 4; AMIRA, submission no. 21, p. 3; UWS, submission no. 22, p. 4; Academy of Technological Sciences and Engineering, submission no. 30, p. 2; Telstra, submission no. 37, p. 1; and Mr Michael Rice, submission no. 50, p. 2.

152 UWS, submission no. 22, p. 4.

153 AMIRA, submission no. 21, p. 3.

154 Telstra, submission no. 37, p. 1. See also Academy of Technological Sciences and Engineering, submission no. 30, p. 2.

155 Academy of Technological Sciences and Engineering, submission no. 30, p. 1 and ASTEC, submission no. 42, p. 9.

*An increasing responsibility is falling on the public sector to fund longer term and generally pre-competitive research which is in the national interest. There is growing recognition elsewhere in the OECD region that the public sector may reasonably be expected to fulfil this role.*

*In contrast, industry R&D around the world is becoming more focussed on the shorter term and company boards are becoming increasingly reluctant to fund medium to long term projects.<sup>156</sup>*

### **Relevance of the R&D to industry**

3.19 Despite the factors mentioned above, there is no doubt that the R&D conducted in sectors affected by competition reforms now has more relevance to the commercial needs of industry. For example, surveys of Australian electricity R&D demonstrate a shift to customer focus, particularly improvements in metering, customer information and communication.<sup>157</sup>

3.20 This change in focus is hardly a surprise, given that competition reforms were applied principally to induce efficiency gains.<sup>158</sup> Decisions about R&D in utilities are now taken at a much higher level, and the R&D is oriented towards matters which have a more immediate value to the utility concerned. The Academy of Technological Sciences and Engineering advised that:

*R&D expenditure is seen increasingly not as an ad hoc allocation of funds but a management expenditure based on detailed financial analysis of the anticipated effects of defined outcomes. This tighter focus on outcomes has been of great value, both to the organisation commissioning the project and the prospective researchers. In the former case it has allowed sensible economic analysis of potential benefits leading to logical decisions to invest in R&D. In the latter case it has allowed researchers to define their program and targets more clearly... Additionally the level of implementation of the results of research is considered to have improved.<sup>159</sup>*

3.21 Other organisations cited similar benefits. The ESAA, which noted that research commissioned by its members has “far more relevance and applicability to immediate business needs” than was the case in the past, stated that:

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156 DPIE, submission no. 46, p. 14. See also Rio Tinto, submission no. 25, p. 3.

157 DIST, submission no. 48, p. 13.

158 *ibid*, p. 14.

159 Academy of Technological Sciences and Engineering, submission no. 30, pp. 3-4.

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*Closer scrutiny of competitive costs has provided a much more strict basis for allocating funds for R&D and in the longer term this will be one of the greatest benefits of the changes that have taken place. It is much easier to justify expenditure on an R&D project where this is presented as a proportion of some identified cost or perceived risk.<sup>160</sup>*

3.22 In common with DIST (see page 28), ASTEC suggested that as the utilities adjust to their new corporate environment they could increase their investment in R&D:

*...we consider as very positive the fact that companies are now viewing R&D much more strategically than in the past and that is part of the business of getting R&D to work for your business objective ... Under the conditions of privatisation it may have been linked with, at least in the short term, a reduction in the funds available. But for a company, if it has the positioning to be able to compete internationally ... then it is very likely it will want to invest in new types of R&D in the future.<sup>161</sup>*

3.23 The Committee agrees that the more commercial focus for R&D will prove beneficial. Where there are difficulties – such as the decline in “public good” and long-term research (see below) – it is appropriate to put structures into place across the economy to facilitate such activities, rather than to portray the decline as a failure of competition policy.

### ***Long-term and “public good” R&D***

3.24 Competition policies have clearly led to a more management-driven focus for R&D. However, there appears to have been a consequent reduction in basic and long-term research, including activities which have a “public good” component. For example, before the impact of policy changes on the energy sector:

*...the ‘Pacific Powers’ and the ‘SECs’ of the world were funding a lot of research into long-term things like renewable energy, more interesting ways of conserving energy, and the like. That has just been scrapped completely. Basically, their focus is very short-term on trying to knock 0.1 of a cent off the price of generating power; that is very much the focus of their work. It has*

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160 ESAA, submission no. 40, p. 6.

161 Professor Ron Johnston, ASTEC, transcript of evidence, p. 214.

*been a similar experience in a number of the other public authorities.*<sup>162</sup>

3.25 The Chief Executive of the Institution of Engineers, Dr John Webster, also observed that:

*... there is a noticeable diminution in the amount of work going into the provision of energy to rural and remote communities where a number of the larger public sector entities had a long-term commitment to work in that area. I am not necessarily talking about just straightforwardly stringing cable across mile after mile of the outback. I am really talking about new and innovative ways of providing electrical power and with it often access to clean water and proper sewerage facilities to remote communities by means that are less expensive and unreliable than the old diesel generator.*<sup>163</sup>

3.26 In that context, Dr Webster expressed the Institution's regret at the withdrawal of funding for the ERDC (discussed at pages 38 and 39).<sup>164</sup>

3.27 Whether the focus on short-to-medium-term R&D will ultimately meet *actual* commercial needs, as distinct from *perceived* commercial needs, will become clear only in retrospect. The Academy of Technological Sciences and Engineering suggested that long-term commercial health depends on strategic basic research, the maintenance of which is now "entirely dependent on the maturity of the managements involved".<sup>165</sup>

3.28 The utilities' reduced interest in long-term R&D is reflected in diminished support for such R&D in other agencies, notably universities. The University of NSW confirmed that it is now "far more difficult" to get the utilities to focus on longer term issues. The university also suggested that its very successful solar photovoltaic research was in jeopardy because of the (then) mooted privatisation of the principal supporter of the research, Pacific Power.<sup>166</sup>

3.29 The effects described are being felt outside the energy sector. According to the Institution of Engineers, basic health research is being jeopardised by restructuring of the public hospital system, where research for

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162 Mr Peter Laver, Academy of Technological Science and Engineering, transcript of evidence, p. 12.

163 Dr John Webster, Institution of Engineers, Australia, transcript of evidence, pp. 96-97.

164 *ibid.*, p. 97.

165 Academy of Technological Sciences and Engineering, submission no. 30, p. 5. See also Queensland Government, submission no. 27.1, pp. 3-4.

166 UNSW, submission no. 33 and Mr Peter Cook, UNSW, transcript of evidence, p. 125.



some of our most successful biomedical exports was initiated (page 69 also refers).<sup>167</sup>

3.30 Specifically in relation to “public good” research, ASTEC advised that:

*...the evidence we have is that in some areas the public good research – research which is primarily designed to provide general value to the public in areas of, for example, collecting data on environmental flows or environmental changes; functions which were once carried out by these corporations as part of their role – clearly no longer falls directly within [their] charter of responsibilities and is tending to be dropped.*<sup>168</sup>

3.31 In addition, the new commercial entities are less likely to give away information that has some market value.<sup>169</sup> The CSIRO confirmed that small utilities are less willing to provide information to it for research purposes, while the ESAA advised the Committee that:

*The new industrial requirements for confidentiality and control of intellectual property have prevented publication of much R&D and this trend will increase.*<sup>170</sup>

3.32 Limited access to data and reduced “public good” research are inter-related problems. In particular, concerns emerged during the inquiry about basic long-term environmental data collected by the former public-sector water utilities.<sup>171</sup>

3.33 As explained by the President of FASTS, Professor Peter Cullen:

*We are starting to see, in some areas, corporatised bodies saying that they own data, it is not necessarily a public asset and they do not even necessarily have to make it available for a fee. We are battling that. I am arguing that, in the water area, all data collected should be publicly available. I am delighted to say that the ACT puts all the*

167 Institution of Engineers, Australia, submission no. 31, p. 6 and NHMRC, submission no. 36.

168 Professor Ron Johnston, ASTEC, transcript of evidence, p. 209.

169 CSIRO, submission no. 15 and ASTEC, submission no. 42, p. 12.

170 ESAA, submission no. 40, p. 6.

171 Academy of Technological Sciences and Engineering, submission no. 30 p. 1 & p. 4; ASTEC, submission no. 48, p. 3; Mr Peter Laver, Academy of Technological Sciences and Engineering, transcript of evidence, p. 18; Professor Peter Cullen, FASTS, transcript of evidence, pp. 69-70 & p. 72; Dr John Webster and Ms Lynne Reeder, The Institution of Engineers, Australia, transcript of evidence, pp. 95-96 & pp. 98-99; Dr Paul Wellings, DIST, transcript of evidence, p. 195; and Professor Ron Johnston, ASTEC, transcript of evidence, p. 209.

*water quality data on the Web, so it is publicly available. That is not happening in all jurisdictions and, again, it is a consequence of the commercialisation of government entities.*

*...My particular concern [is] to do with data such as stream flow and water quality data, which has traditionally been collected by governments and is now being handed across to new corporatised or fully privatised entities. Those organisations are given that data. If they decided that it was not worth the storage capacity, they could take it to the tip; there is no guarantee that they would keep 100 years of water flow records. They are not likely to do that, but there is no assurance that that publicly collected data is even to be maintained. If it is maintained, whether they have to give it to anyone else, or even sell it to anyone else, is also unclear. They can, if that is in their commercial interests. But if they are also the organisation responsible for sewage discharge, it might not be in their interests to let that data out to others.*

*Where we require data to be collected, either through government contracts or as part of [environmental] monitoring requirements, I would like to see a clear assertion that that is publicly owned and should be publicly accessible. I think it can go onto the Web now, where there are virtually no retrieval costs for anyone. The earlier argument was: 'It costs us too much to have people burrowing around to find it.' I think that has gone. The Web is a good example and I hope other jurisdictions will follow the ACT example.<sup>172</sup>*

3.34 The Institution of Engineers noted that access to such information, in addition to being essential for governments to make rational long-term decisions, is also necessary to create a genuinely competitive commercial environment:

*Otherwise you would simply create monopolies and duopolies, because if the property belongs to the people who are already in the field, there is no way that a new entrant can credibly become part of the game.<sup>173</sup>*

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172 Professor Peter Cullen, FASTS, transcript of evidence, pp. 69-70 & p. 72.

173 Dr John Webster, The Institution of Engineers, Australia, transcript of evidence, p. 98.

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#### Recommendation 4:

**3.35 The Committee recommends that, as part of ongoing reforms in the water sector, the government seek the agreement of the Council of Australian Governments on common standards for:**

- **continued public access to water flow and water quality data collected by the former public sector water utilities; and**
- **ongoing responsibility, either through nominated public sector agencies or the new water service providers, for collecting such data and making it publicly available.**

3.36 The Institution of Engineers has suggested that governments may have to be prepared to pay a market price for data based on its value for each application, rather than its initial cost of collection.<sup>174</sup> Obviously the market value of the data should be determined as part of the process suggested in Recommendation 4, particularly if governments wish to impose an ongoing collection and dissemination requirement on commercial service providers. This issue is discussed further at pages 57 to 59.

#### **A “stocktake” of long-term and public good R&D?**

3.37 ASTEC informed the Committee that:

*... any adverse impact of the reforms upon public good R&D and data collection [is] likely due to a failure to appreciate the range of activities carried out by a utility at the time of its reform. As such, they can often be traced to the implementation of the reforms, rather than the reforms per se. Ideally, implementation would involve all activities carried out by the target organisation being first identified and then, as part of the reform process, those activities transferred to other more appropriate public bodies or built into the organisation’s licence conditions in a similar way to a community service obligation.*<sup>175</sup>

3.38 A Community Service Obligation (CSO) arises when a government requires an enterprise to carry out activities which it would not elect to do on a commercial basis, or which it would only do at higher prices. CSOs generally relate to governments’ broader policies or social goals. The removal of barriers to competition for government businesses undermines their ability to

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174 The Institution of Engineers, Australia, submission no. 31, p. 6 and the National Committee on Coastal and Ocean Engineering, *At What Price Data?*, The Institution of Engineers, Australia, November 1993 (exhibit no. 2).

175 ASTEC, submission no. 42, pp. 13-14.

fund CSOs through hidden cross-subsidies; as such, a more transparent funding of CSOs (through government budget allocations or specific charges) is encouraged. A range of CSOs are now funded in this way.<sup>176</sup>

3.39 Of course, in some sectors ASTEC's suggested transfer of functions to more appropriate bodies might have already occurred:

*... you cannot just look at an individual organisation's activity in research and development and assume that, because it is becoming privatised and it is reducing its public good component, the public good component is not being undertaken somewhere else, and perhaps better.*<sup>177</sup>

3.40 An example might be the work of Telstra Research Laboratories (TRL). While TRL has adopted a narrower, more commercial focus for its R&D, other organisations – such as the CSIRO, the Institute for Telecommunications Research, the Australian Photonics CRC, the CRC for Signal Processing and some of Telstra's supply companies – appear to have picked up much of the longer-term work.<sup>178</sup> However, such matters should not be left to chance. DIST, the NCC, the CSIRO and the Australian Academy of Science all made similar proposals to that of ASTEC.<sup>179</sup>

3.41 The Committee agrees that:

- the R&D conducted by public sector reform targets should be assessed at an early stage of the reform process, with explicit arrangements made to safeguard “public good” activities; and
- there should be an R&D “stocktake” to quantify the loss of public good activities previously undertaken by public sector utilities which have been the subject of public policy changes such as corporatisation or privatisation.

3.42 The Committee does not anticipate that commercially valuable information would actually be released in the stocktake. As explained by DIST:

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176 See *Commonwealth Competitive Neutrality Statement*; National Competition Council, *Competitive Neutrality Reform: Issues in Implementing Clause 3 of the Competition Principles Agreement*, AGPS, 1997, p. 20; Industry Commission, *Microeconomic Reforms in Australia*, p. 6; and Productivity Commission, *Inquiry into the Impact of Competition Policy Reforms on Rural and Regional Australia*, Draft Report, pp. 89-91.

177 Mr Michael Holthuyzen, DIST, transcript of evidence, p. 193.

178 Australian Photonics CRC, submission no. 29; Telstra, submission no. 37, pp. 1-2; Dr John Radcliffe, CSIRO, transcript of evidence, p. 48; and Dr Mark Sceats, Australian Photonics CRC, transcript of evidence, pp. 135-137.

179 Australian Academy of Science, submission no. 10.1, p. 1; CSIRO, submission no. 15.1; DIST, submission no. 48, p. 1 & pp. 13-14; Mr Ed Willett, NCC, transcript of evidence, pp. 4-6 & p. 10; and Mr Michael Holthuyzen, DIST, transcript of evidence, p. 187 & p. 222.

*...you would [not] expect that all details or information relating to research and development would necessarily be publicly available as a result of that stocktake. We would want to see a greater transparency of where that information might be, who holds it, how it is held, including its classification, so that decisions regarding whether or not some people or others have access to that information can be made bilaterally or however. It is envisaged by us not that a stocktake would result in all information being necessarily publicly available but that we become aware that it exists in one form or another.*<sup>180</sup>

3.43 Also, any recommendation in this regard needs to acknowledge that most utility services are provided under the auspices of State and Territory governments. A stocktake initiative would therefore be of limited value without the co-operation of those governments.<sup>181</sup>

**Recommendation 5:**

**3.44 The Committee recommends that the government propose to the Council of Australian Governments that a stocktake of the R&D activities of utility service providers be carried out, to quantify any substantial loss of such activities – particularly those with a “public good” component – resulting from the application of competition policy and like reforms to the electricity, water, gas and telecommunications sectors. A possible mechanism for such a stocktake could be a review by the National Competition Council. Where functions with a net benefit to the community are no longer being performed due to a lack of commercial incentives, those functions should be either:**

- **performed by the new service providers and funded by the government in a manner similar to a Community Service Obligation; or**
- **transferred to an appropriate public sector research agency, again with funding adjustments as required.**

180 Mr Michael Holthuyzen, DIST, transcript of evidence, p. 222.

181 DIST, submission no. 48, p. 14.

**Recommendation 6:**

**3.45 The Committee recommends that the government propose to the Council of Australian Governments that, in future, R&D activities undertaken by competition policy reform targets be identified at an early stage of the reform process. Where the continued performance of non-commercial “public good” and longer-term research is deemed to be desirable, arrangements should be made as per Recommendation 5.**

3.46 Exactly how the early identification of R&D activities should be built into the process is a matter for governments to consider. One suggestion from the Institution of Engineers is that a standing committee of the NCC be established to monitor the effects of competition policy on innovation and technology development.<sup>182</sup> DISR noted that the issues raised above could be considered by the National Innovation Summit working group on “institutional structures” and their effectiveness.<sup>183</sup>

3.47 If recommendations 5 and 6 are adopted, governments will have to decide on a case-by-case basis which of the two options set out in the recommendations – imposing functions on the new service providers, or transferring those functions to public sector research agencies – is the most appropriate.

3.48 The NCC cautioned that commercial service providers will not always be the right organisations to undertake activities like long-term and “public good” research. Certainly, commercial organisations should not have to cross-subsidise these activities:

*... there is a question about whether that should be the business of organisations who are focused on provision of water services [for example] or whether we should be providing that task more generally to an organisation who is better equipped to undertake that responsibility. That might involve the purchasing of data or the contracting of service providers to undertake those activities because they are in the best place to provide it.*

*... what we have identified is that the provision of utility services in particular, on the basis of what you might call altruism – the way these businesses have been conducted in the past – does involve considerable waste of resources.*

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182 The Institution of Engineers, Australia, *Engineering the Transition to Competitive Utilities*, p. 19.

183 DISR, submission no. 48.2, p. 7.

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*Focusing those service providers on their job of service provision involves considerable community benefits.*<sup>184</sup>

3.49 The Committee again emphasises the importance of stable funding for organisations such as the CSIRO, the CRCs and the universities, if those organisations are expected to fill a void left by corporatised and privatised agencies.

### ***Certain policy changes in public sector R&D***

3.50 A range of policy changes are now being applied to public sector R&D, including “user pays” principles in higher education, and pricing and accountability reforms for government science agencies.<sup>185</sup>

3.51 As DIST noted, competition initiatives may have negative consequences if they are inappropriately applied to government research organisations that undertake significant “public good” activities.<sup>186</sup> The Committee heard concerns about the application of external earnings targets to government science agencies, and competitive neutrality principles to the CSIRO.

### **External earnings targets**

3.52 The government has implemented a range of policies aimed at forging connections between its research agencies and industry. One such policy initiative was the application of “external earnings” targets to the CSIRO, the Australian Institute of Marine Science (AIMS) and the Australian Nuclear Science and Technology Organisation (ANSTO) in 1988. Those agencies were required to find up to 30 percent of their funds from sources other than annual appropriations; that is, from research consultancies and contracts.<sup>187</sup> External earnings targets have since been applied to the Australian Geological Survey Organisation (AGSO), the Bureau of Rural Sciences (BRS) and the Australian Bureau of Agricultural and Resource Economics (ABARE).

3.53 Although it is difficult to establish cause and effect, there are suggestions that ongoing external earning targets might discourage collaboration. According to Mr Dick Wells of the Minerals Council of Australia:

*... certainly the pressure from management ... is to get as much as you can in terms of external revenue earnings to*

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184 Mr Ed Willett, NCC, transcript of evidence, p. 5.

185 DIST, submission no. 48, p. 3.

186 *ibid*, p. 1.

187 The targets are 30 percent for CSIRO and 20 percent for AIMS and ANSTO.

*your own bottom line. That has also led to tension at times between the CSIRO and the CRCs, which I think was exhibited in the Mortimer inquiry. The CSIRO was contributing larger numbers of staff to the work of the CRCs, but the external revenue earnings targets were going to the bottom line of the CRCs, not the CSIRO. If you were a CSIRO manager, I think you would be saying, 'I would like to have some of those resources back in my own division contributing to what I am going to be judged by at the end of the year.'*<sup>188</sup>

3.54 Mr Wells questioned whether the usefulness of external earnings targets in encouraging an industry focus for public sector R&D is coming to an end.<sup>189</sup> The Australian Academy of Science suggested that meeting external earnings targets often becomes the goal, rather than meeting industry's research needs.<sup>190</sup>

3.55 While the government sets targets for each organisation's external earnings, it is important to realise that this applies to total funds across the organisation. In practice, it is easier for the organisation's applied research programs to achieve high levels of private funding. AMIRA gave the example of the CSIRO Division of Minerals, which has achieved external earnings of 45 percent.<sup>191</sup>

3.56 External earnings requirements present greater difficulty for the "public good" components of agencies' programs. DPIE submitted that there are limits to extending external funding without detracting from public good research for which appropriations are allocated.<sup>192</sup> The CSIRO Section of the Community and Public Sector Union (CPSU) argued that the CSIRO no longer has a healthy balance between basic and applied research (the CSIRO responded that "overall a healthy balance is being maintained", although the balance of research would change if the external earnings target was increased).<sup>193</sup>

3.57 The Academy of Science referred to the Mortimer review's recommendation that an external earnings target of 50 percent be applied to the CSIRO:<sup>194</sup>

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188 Mr Dick Wells, Minerals Council of Australia, 14 May 1998 private briefing transcript, p. 6 (transcript authorised for publication 12 August 1999).

189 *ibid.*

190 The Australian Academy of Science, submission no. 10, enclosed letter dated 29 August 1997 to the Hon John Moore MP, p. 3.

191 Mr Richard Davies, AMIRA, transcript of evidence, p. 31.

192 DPIE, submission no. 46, p. 8.

193 CSIRO, submission no. 15.1 and CSIRO Section of the CPSU, submission no. 28, pp. 4-5.

194 Mortimer Review of Business Programs, pp. 122-124.



*The recommendation that CSIRO achieve 50% external funding is, in our view, unrealistic and would impact adversely on its strategic research. It also does not take into account the diversity of CSIRO. An overall requirement for this level of external funding would require a number of Divisions to achieve 70% or even 100% external earnings. Applying the recommended targets will reduce greatly CSIRO's capacity to perform its strategic research.*<sup>195</sup>

3.58 The Academy also stated that Mortimer's recommendations that the Rural RDCs be merged and that public funding for the CRC program be substantially reduced would make it more difficult for the CSIRO to locate external funds.

3.59 The aim of achieving closer ties between government-funded research bodies and industry has in large part been achieved. There is some evidence that the balance between commercially-oriented research and "public good" research may now need to be addressed.

**Recommendation 7:**

**3.60 The Committee recommends that the government bear in mind the public good when setting the external earnings targets for Commonwealth research agencies.**

**Competitive neutrality**

3.61 "Competitive neutrality" requires that government business activities not enjoy competitive advantages simply by virtue of public sector ownership (pages 9 and 13 of this report refer). Under Commonwealth competitive neutrality guidelines, the following organisations are deemed to be significant as they have been structured specifically to operate along commercial lines:

- all government business enterprises (GBEs) and their subsidiaries;
- other share-limited trading companies; and
- all designated business units.

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195 Australian Academy of Science, submission no. 10, enclosed letter dated 29 August 1997 to the Hon John Moore MP, p. 3.

3.62 Other activities which operate in accordance with the definition of a business, and have commercial receipts exceeding \$10 million per year, are assessed on a case-by-case basis. This category includes activities undertaken by Commonwealth departments, agencies, authorities and their subsidiaries.<sup>196</sup>

3.63 The CSIRO, for example, is now required to include a commercial pre-tax rate of return and tax equivalent components in its charges for consulting and technical services. It is also required to use full cost pricing for research project bids, unless there are national interest considerations, and include allowances for tax and return targets if these are known to be incurred by competing bidders.<sup>197</sup>

3.64 The CSIRO argued that:

*[Competitive neutrality, or] CN measures should not eventually apply to CSIRO research because the majority of CSIRO research is of a non-competitive (public good) nature; it is difficult to distinguish between research for commercial and public benefit purposes; and the possibility of genuine private sector competition is small. The implementation of further CN principles may undermine the fundamental strategic purpose of CSIRO. Applying taxes and return requirements to CSIRO research will increase client R&D costs and have an adverse impact on both the level and direction of R&D investment in Australia.*<sup>198</sup>

3.65 The CSIRO expressed concern that other public sector R&D providers, many of which are CSIRO's direct competitors in certain sectors, have been excluded from the competitive neutrality requirements because their commercial receipts are below the \$10 million threshold.<sup>199</sup>

3.66 The AVCC similarly expressed concern about the application of competitive neutrality principles to universities' R&D and consultancies:

*... it is not always possible to separate structurally the commercial aspects of these activities. The distinction between research and the commercial provision of R&D services is a difficult issue, and the line between commercial and non-commercial is not easy to define.*

*Furthermore, the links between universities, and between universities and industry are important to achieving the*

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196 Commonwealth Competitive Neutrality Statement, p. 6.

197 CSIRO, submission no. 15.1.

198 CSIRO, submission no. 15.

199 *ibid.*

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*Commonwealth aims for higher education, and structural separation will not always be desirable.*<sup>200</sup>

3.67 The Committee has taken insufficient evidence to make recommendations on these matters, but draws to the government's attention the concerns of the CSIRO and the AVCC. In so doing the Committee notes that application of competitive neutrality principles, as with competition policy in general, is required only to the extent that the benefits outweigh the costs.

## Research infrastructure and equipment

3.68 The Committee received only limited evidence on the effects of public policy changes on research infrastructure and equipment. Of greater concern to many participants in the inquiry was inadequate funding of universities' research infrastructure. FASTS, for example, criticised:

*... the refusal by Government to meet the costs of running a university system which is then forced to adopt grotesque cost-cutting measures.*<sup>201</sup>

3.69 University funding is examined in Chapter 4.

3.70 As was noted by ASTEC, any shift in the R&D undertaken in sectors affected by public policy changes would logically lead to a corresponding shift in research infrastructure and equipment:

*Not surprisingly, spending by the utilities on R&D infrastructure and equipment has followed the overall trend in their R&D activities. To the extent [that ASTEC] was able to determine, a shift in the type of infrastructure and equipment investment is more likely to have occurred rather than an overall decrease. The purchase of infrastructure and equipment to support development of core technology may well have declined. But, almost certainly there has been greater investment by the utilities in infrastructure and equipment to support integration and adaptation of 'off-the-shelf' core technology, and in other technology used to anticipate and meet customer needs.*<sup>202</sup>

3.71 As with other aspects of this inquiry, there are difficulties in attributing changes in research infrastructure and equipment over the past ten years to public policy changes. In telecommunications, for example, the shift from network R&D to systems R&D has led to declining investment in

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200 AVCC, submission no. 49, p. 7.

201 FASTS, submission no. 26.

202 ASTEC, submission no. 42, p. 11.

equipment, as the equipment required for systems development is less expensive than the specialised equipment required previously. The decline in investment has therefore resulted more from a change in the nature of the work rather than from policy changes. This has been offset by an increased investment in computing equipment.<sup>203</sup>

3.72 Also in relation to telecommunications R&D, the Institution of Engineers noted the effects of competition on *access* to research infrastructure:

*... one of the roles that Telstra, as a monopoly, performed was to provide access to facilities for testing devices and applications in an even-handed and credible manner. That is very important to any small company which wants to manufacture new telecommunication devices and so on.*<sup>204</sup>

3.73 Part of the competition policy process should be to identify the loss of such functions and, where appropriate, to transfer those functions to a public sector agency (see pages 57 and 58). For the telecommunications example cited above, the Commonwealth Department of Communications, Information Technology and the Arts (CITA) advised the Committee of its “Testing and Conformance Infrastructure Program”. The program’s objective is:

*... to help support the development of the testing and conformance infrastructure necessary for Australian information technology and communications firms to have their hardware, software and services enter the domestic and international markets in a timely manner.*<sup>205</sup>

3.74 The Committee notes that “resource and infrastructure consolidation and co-operation” is a topic to be examined by a National Innovation Summit working group.<sup>206</sup>

3.75 The Committee also took evidence on the effects of outsourcing on access to research infrastructure in the health sector. This matter is examined at pages 69 and 70.

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203 Academy of Technological Sciences and Engineering, submission no. 30, p. 5 and Telstra, submission no. 37, p. 2.

204 Dr John Webster, The Institution of Engineers, Australia, transcript of evidence, p. 105.

205 CITA, *Testing and Conformance Infrastructure Program: Information for Full Applications*, January 1999 (exhibit no. 29).

206 DISR, submission no. 48.2, p. 7.

## Outsourcing

3.76 Outsourcing of public sector functions has increased during the decade under review. For example, the South Australian government has contracted out its entire water and sewerage system to the United Water consortium, while other State governments are outsourcing the construction and operation of treatment plants, stormwater and supply pipelines. Contracts of this type effectively change the role of a State authority from that of a service operator to an agency purchasing services on behalf of the community.<sup>207</sup>

3.77 ASTEC noted that such changes are:

*... effectively transferring the incentive to innovate from the owners of the utilities to their suppliers. R&D has shifted more towards the purchaser-provider model and a significant demand pull for technology appears to be emerging.*<sup>208</sup>

3.78 Outsourcing has some beneficial effects for R&D. For example, the University of NSW advised that some former public sector entities have turned to universities for their R&D needs “and funds have flowed equivalently”.<sup>209</sup> DIST suggested that:

*A possible consequence of privatisation within a sector may be to increase R&D in other sectors. This could occur if R&D is outsourced from the newly privatised company and is instead performed by suppliers to that company. Shifting R&D to suppliers can have a number of consequences. The first may be to increase the R&D skills of those suppliers, a result which is likely to be beneficial in that those suppliers are then able to provide more innovative inputs to other customers.*<sup>210</sup>

3.79 DIST noted that the overall benefit will vary depending on the type of R&D skills developed and the outsourcing process adopted. ASTEC observed that utilities often use “risk and reward” contracts. Such contracts can provide a greater incentive for contractors to take an innovative approach, as often they allow for retention of any savings provided quality standards are maintained.<sup>211</sup>

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207 “The Thirst for Water Reform”, *The Australian Financial Review*, 10 August 1998.

208 ASTEC, submission no. 42, p. 13.

209 UNSW, submission no. 33. See also AVCC, submission no. 49, p. 3.

210 DIST, submission no. 48, p. 16.

211 ASTEC, submission no. 42, p. 10.

- 3.80 The Australian Academy of Science urged governments to:
- a) recognise that outsourcing can legitimately take account of public-good benefits, and
  - b) provide funding incentives to cover the costs of securing those benefits.<sup>212</sup>

3.81 The Institution of Engineers has similarly argued that:

*... innovative practices could be curtailed if organisations simply manage functions which have been contracted to them and do not pay sufficient attention to the longer term aspects of planning, development and technological advances ... government can put in place policies which address such issues as financing R&D, by allocating incentives and rewards to encourage more innovative behaviour.*<sup>213</sup>

### **Recommendation 8:**

**3.82 The Committee recommends that the government ensure that outsourcing processes which encourage innovation and take account of “public good” benefits are examined at the National Innovation Summit.**

3.83 While outsourcing has its benefits it can also exacerbate problems mentioned earlier, such as the move away from long-term R&D – as utilities which outsource R&D tend to focus on “short-term, troubleshooting projects”.<sup>214</sup> The “critical mass” for R&D can also be affected by outsourcing and downsizing in former centres of excellence, with experts either leaving the field or being distributed over a number of service providers.<sup>215</sup>

3.84 There are also suggestions that outsourcing can favour overseas R&D providers. The Australian Photonics CRC advised that Telstra is shifting the need for infrastructure R&D to its suppliers, “...but its suppliers are headquartered overseas”.<sup>216</sup> Professor Brian Anderson, the President of the Australian Academy of Science, noted that:

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212 Academy of Science, submission no. 10.1.

213 The Institution of Engineers, Australia, *Engineering the Transition to Competitive Utilities*, p. 2.

214 CSIRO, submission no. 15.

215 The Institution of Engineers, Australia, *Engineering the Transition to Competitive Utilities*, p. 13.

216 Dr Mark Sceats, Australian Photonics CRC, transcript of evidence, p. 136.

*... outsourcing appears to favour bigger entities. In the [information technology] industry the structure of the industry is such that this means that outsourcing is probably going to boost foreign owned corporations relative to our domestically owned, because the structure of the industry is one where nearly all the big players are foreign domiciled.*<sup>217</sup>

### **The need to retain “in-house” expertise**

3.85 DIST advised the Committee that:

*Companies are not able to outsource all R&D and still remain competitive. Academic studies show that companies must retain technical expertise in order to make the most use of new technologies and techniques that are brought in from external sources. While the level of R&D cooperation and contract R&D have a significant positive effect on internal R&D, they only do so if the outsourcing companies have retained a capacity in the form of an R&D department.*<sup>218</sup>

3.86 Several submissions stressed the importance of organisations retaining sufficient “in-house” R&D expertise to make informed decisions when outsourcing. The Institution of Engineers noted that this was one of the main issues to emerge from its inquiry into the impact of public policy change on infrastructure and engineering services.<sup>219</sup>

*One of the difficulties often is that, in the enthusiasm to capture the short-term economic benefits, there has been some tendency to overlook the necessity for governments themselves to remain expert purchasers of a service and to be able to identify what might be seen as longer-term public good needs. This may be something which is helpful for those state governments which are not so far down the track to consider when they go into their own processes of privatisation.*<sup>220</sup>

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217 Professor Brian Anderson, Australian Academy of Science, transcript of evidence, p. 201. See also “Our Government Lets Down Technology Developers”, “IT’s the Poor Cousin in Australia” and “Fahey Rejects IT Critics”, *The Australian Financial Review*, 6, 9 and 12 April 1999.

218 DIST, submission no. 48, p. 17.

219 The Institution of Engineers, Australia, submission no. 31, p. 2.

220 Dr John Webster, Institution of Engineers, Australia, transcript of evidence, p. 98.

3.87 FASTS advised that government agencies now have considerably less in-house technical expertise than previously, and often "...do not even know the right question to ask of external experts or consultants".<sup>221</sup> Such a lack of in-house expertise, in addition to having a negative effect on the *purchasers* of research, would ultimately affect the providers of that research. This in turn could lead to adverse social consequences.

*If purchasers do not know exactly what they need, providers also have some problems because providers are trying to keep teams of people together. Therefore, they have an interest in selling whatever they can to keep the money flowing in to keep their teams intact. If the purchaser comes up with a proposal that is perhaps not very well thought through, is going to take a lot of staff and be quite costly, the temptation for the provider is to say, 'Certainly we can do that, and here's what it will cost you.' ... You can even take that further. In the environmental area it is not hard to argue, in fact it has been argued in the United States, that these reforms have led to pressures to beat up issues just to generate funding.*<sup>222</sup>

3.88 There has been speculation that policies such as privatisation and outsourcing led to some of the more newsworthy failures in public infrastructure which occurred during the course of the inquiry. These include the water crisis in Sydney in July 1998 and earlier power failures in Queensland and Auckland, New Zealand.

3.89 In the case of the Sydney water crisis, the Committee notes that the contract between Sydney Water and the privately-operated Prospect filtration plant apparently did not require the plant to screen for certain dangerous pathogens:

*If so, this would not be a failure of private provision of water services – it would be a failure of government, as the purchaser of water services for the community, to set out what it requires from the contracted provider of those services.*<sup>223</sup>

3.90 The inquiry did not establish that the Australian failures were attributable to privatisation or outsourcing. However, the Committee stresses to all Australian governments (and their utility service providers) the need to retain sufficient in-house R&D expertise to make informed decisions when contracting out services. The Committee also stresses the need for corporatisation and outsourcing processes to set out performance standards and a clear division of responsibility.

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221 Professor Peter Cullen, FASTS, transcript of evidence, p. 66.

222 *ibid*, p. 67.

223 "The Thirst for Water Reform", *The Australian Financial Review*, 10 August 1998.



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### Recommendation 9:

**3.91 The Committee recommends that the government acknowledge the need to retain sufficient “in house” R&D expertise to make informed decisions when contracting out services, and that the government requests the States to do likewise.**

3.92 A related issue is the effect of outsourcing on employment opportunities and the skills base. For example, FASTS (which represents some 50 000 working scientists) advised that outsourcing has weakened demand for scientists where water authorities have been sold to overseas interests.<sup>224</sup> ASTEC warned that:

*...much of the total skills base which the utilities and government competition policy makers are currently relying upon, was accumulated in the past through professional development and work experience of employees in former water boards and electricity commissions.<sup>225</sup>*

3.93 The lack of opportunity for graduates to develop the skills once provided through employment in the utilities could be a serious problem in the future. Some issues related to employment of graduates are noted in Chapter 4.

### ***Outsourcing and health research***

3.94 Contracting out hospital services appears to have had potentially serious effects on health research. The National Health and Medical Research Council (NHMRC) informed the Committee that:

*It has been repeatedly brought to the attention of the NHMRC that services and facilities previously made available through the public hospital system have been withdrawn, or only made available at high cost. One unintended consequence will be to undermine the vital role that clinical research plays in translating research into practice. Clinical research is the bridge between health and medical research and the development of evidence-based, cost effective interventions and, as such, is important not only to the quality of care, but also to containing the overall level of health outlays.*

*... Unfortunately the important benefits of clinical research to the health system are not usually taken into account in any analysis of the cost-effectiveness of outsourcing*

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224 FASTS, submission no. 26.

225 ASTEC, submission no. 42, p. 12.

*individual health services... At the level of individual hospital administration, this creates an extremely strong disincentive to support clinical research. For research funding organisations such as the NHMRC, it creates flow-on pressures on our ability to support research through moving the costs to individual research grants and increasing the number of applications for support. At a national level, this tendency starts to place in jeopardy our capacity for high quality clinical research. The longer-term impact on the health system will be a reduction in overall standards of care.*<sup>226</sup>

3.95 Further to the comments at pages 65 and 66 about outsourcing being structured to allow for public good benefits, the role of clinical research in the public hospital system should be acknowledged and funded. Precisely how this should occur is a matter Ministers for Health could consider. The NHMRC suggested, for example, that research and teaching be treated as a separate item in hospital “casemix” funding.<sup>227</sup>

**Recommendation 10:**

<p><b>3.96 The Committee recommends that the Commonwealth Minister for Health raise with State Ministers for Health the need to make explicit financial provision for clinical research when outsourcing public hospital services.</b></p>
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226 NHMRC, submission no. 36. See also NHMRC, transcript of evidence, pp. 176-177 & pp. 183-184.

227 Professor Colin Chesterman, NHMRC, transcript of evidence, pp. 183-184. “Casemix” funding is a system under which hospitals are paid the same amount for equivalent work, rather than on the basis of historical budgets. The casemix system is intended to reward lower-cost hospitals and creates incentives for additional throughput.