On the score of polemic, Palda's book scarcely counters the "political posturing" of the bureaucrats and academic economists it so mightily condemns. It merely tips the scales the other way. These concerns are not peculiar to Canada. The 1985 OECD Examiners' review of the Australian situation found it necessary to remind us that, "it would be quixotic, to say the least, for Australia to pursue a purely market policy in a domain where internal market imperfections. . .are of dominating importance".

What Palda's study does usefully do is set out some of the controversies, debates and methodological problems associated with the economics of innovation. Ironically it also highlights some of the dilemmas and constraints on policy analysts — not least of which is the conflicting nature of findings on vital issues. Palda also provides a useful compendium of sources, statistical data and a colourful selection of corporate and parliamentary policy pronouncements. His snapshot case histories have the advantage of versatility (they can be drawn on to support conclusions directly opposed to those Palda makes). In short, recommended adversarial reading for introductory courses on the micro-economic impact of innovation; for the business-literate scientist; and as a case study in the politics of objectivity for the Science-Technology-and Society student.

Jean Buckley-Moran

University of New South Wales

Future Directions for CSIRO. A Report to the Prime Minister by the Australian Science and Technology Council (Australian Government Publishing Service, Canberra, 1985) pp. 94, ISBN 0-644-04597-3.

Our national science colossus, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), is once more up for review. It is now a decade since the Fraser government commissioned the first independent inquiry into CSIRO, chaired by Professor Arthur Birch. That review proceeded in the wake of fundamental questions raised about the Organisation, set up originally in 1926, and nurtured on the principle that government support of high quality, independently designed basic and applied research would serve the needs of the nation. Completed in August 1977 and influenced by some trenchant questions put by the OECD Examiners on the effectiveness of CSIRO's management of its resources in their broad report on Australian science and technology two years before,¹ the Birch report made 122 recommendations to government and marked a serious reappraisal of Australia's central organ of scientific research.

Essentially the Birch report recognised the autonomy of science and the right of scientists to take responsibility for scientific decisions, but sought to point CSIRO towards "filling a gap in the national research with strategic mission-oriented work" and identifying its research undertaking more directly with national goals. Centrally the report recommended changes in the

structure of CSIRO in the grouping of divisions into research institutes to focus major concentrations of research; it pressed for greater accountability from the Organisation in defining and presenting its policy and its detailed objectives to government and the community; it urged more vigorous national and state consultative machinery; and recommended a more active and effective effort by CSIRO in disseminating information from international and national science and technology innovation for the increased use of national industry. The report also sought closer links among CSIRO, the universities and other tertiary institutions, exchange and interpenetration between these sectors, more short fixed-term appointments in CSIRO to reduce its ageing staff profile, and the prospect of management-initiated retirement.²

Many of these recommendations were embodied in the Science and Industry Research Amendment Act of late 1978: a national advisory council and state committees were set up, research institutes formed, and, under increasing public pressure through the '80s, CSIRO has moved deeper into manufacturing sector research and shaped programs more directly to shortterm, tactical, problem-solving research. Yet, in all institutional change, the conservatism of the institution plays a crucial part. "We make our buildings," said Winston Churchill, "and they in turn shape us." CSIRO has proved a powerful shaper and, with its entrenched science-based ethos and historical detachment from external decision-making, it has proved a slow adapter to organisational and ideological change.

Most notably since the implementation of the Birch report, CSIRO has failed to fulfil key recommendations in lifting its role as the national 'communicator' on science and in the important transfer of applied science and technology to industry. So significant has been the 'short-fall', that a recent review of CSIRO's external communication activities strongly hammered the point that CSIRO must "develop more dynamic, aggressive. imaginative, user-oriented and user-friendly communication practices" (despite an ongoing annual budget of some \$1 million already committed to this field) and adopt "more effective strategies and systems for the interpretation, dissemination and transfer of its information resources".³ A management consultant's report to the review committee strongly corroborated the point. From interviews conducted with personnel in industry, government, the media and scientific research institutions, the consultants found that CSIRO's sustained deficiencies were perceived to be an inadequacy in transferring technology for practical use, a lack of a clear sense of mission, a dominance of scientists' values and ideas, an unreponsiveness to the community, a lock of "commercial management", and being "bureaucratic, defensive and arrogant".4

It is against this background, and shored up by his own strong concern for a national technology and high technology strategy in Australia, that the Minister for Science, Barry Jones, approached the Prime Minister last year with proposals for major reform of CSIRO, including the recommendation that this organisation's conservative executive be replaced, on Chairman Paul Wild's retirement, with a body of part-time industrial members headed by an independent chairman who could introduce dynamic science management into Australia's premier R & D organisation. Prime Minister Hawke declined his

Minister's proposals and resorted instead to the steadying advisory arm of ASTEC within his own department.

A word on ASTEC may be timely. Since its formal inception in 1977, the Australian Science and Technology Council has not been renowned for its incisive and probing analysis of scientific institutions or science and technology policy, though its output of reportage has been large. Its blandness, perhaps, is not surprising. Most of its members were drawn initially from the pure science fraternity (its one sorority member, added in 1984, is a distinguished kidney expert); most are new to policy, while a number of more recently appointed economists and industrialists have, self-avowedly, first heard of the existence and work of the council on receiving invitations to join it. Unlike similar councils overseas, no science or technology policy experts. with the notable exception of the late Leon Peres, have been made members of ASTEC. The permanent secretariat of the council has also incurred criticism for some narrowness in its perspective seen to stem from a concentration in the science-based, rather than social science-based, training of its personnel.⁵ Under its present chairman, Professor Ralph Slatver, ASTEC has, however, developed a more technological and industrial composition and now comprises three pure scientists, two professors of engineering, six company directors or managing directors, an economist, a trade unionist, and the head of an institute of technology.

It is of some interest, then, to learn that the 'first' report prepared on future directions for CSIRO by the ASTEC secretariat, completed in October 1985, was condemned as "wishy washy" and "lacking in intellectual quality" and was strongly resisted by the Minister for Science, the Minister for Industry, Technology and Commerce, Senator Button, by the Department of Science, and by some members of ASTEC. It contained, reported science journalist Jane Ford, "few specific recommendations, little innovative thinking, and no radical suggestions for restructuring the organisation".⁶ After heated debate, it was returned to the secretariat for revision.

The 'second' ASTEC report, presented to the Prime Minister in November 1985, is now under discussion by government. Its recommendations are reproduced below:⁷

- 1. That CSIRO's main role be the conduct of applications oriented research combined with a commitment to ensuring the effective transfer of its research results to end users.
- 2. That in undertaking its main role CSIRO concentrate primarily on research in support of existing and emerging industry sectors and measures to facilitate the adoption of the practical results of its research.
- 3. That CSIRO continue to conduct research into Australia's natural resources and aspects of public health, and co-ordinate this work as closely as possible with other organisations active in these fields.
- 4. That the incoming CSIRO board of directors give consideration to transferring elsewhere research groups conducting pure basic research which is not linked to the major objectives of CSIRO.
- 5. That CSIRO be retained as a single statutory authority.

208 Book Reviews

- 6. That the existing CSIRO advisory council and state and territory committees be discontinued.
- 7. That CSIRO continue to participate widely in the co-ordination mechanisms provided by the commonwealth and state ministerial councils' standing committees and technical subcommittees, the Australian manufacturing council and industry organisations.
- 8. That the CSIRO-universities joint research scheme be expanded as funds can be made available. The scheme should also include other suitable higher education institutions.
- 9. That to increase interaction with industry CSIRO actively seek more contract research from individual firms or groups of firms.
- 10. That CSIRO actively seek opportunities to use the establishment of independent and joint venture companies as a way of making its skills and technology available commercially.
- 11. That Sirotech continue to provide an avenue for links between CSIRO and the broader industrial community. Its activities should supplement rather than supplant direct researcher-to-industry contacts.
- 12. That the level of appropriation funding for CSIRO be maintained.
- 13. a) That the full costs of research and development and other services performed under contract to, or in a joint venture with, industry be charged under normal commercial arrangements unless a demonstrable public benefit area.
 - b) That CSIRO endeavour to stimulate and assist private research, development and consulting services.
 - c) That CSIRO be able to retain its earnings from outside sources.
 - d) That to promote the effective commercialisation of its research, CSIRO be permitted to retain income from inventions arising from research not covered by prior commercial agreement.
- 14. That the present executive of CSIRO be replaced by a board of eight directors consisting of a chairman and six ordinary members plus the chief executive of CSIRO. Apart from the chief executive, all board members should serve part time and be drawn from outside the Organisation.
- 15. That the CSIRO board be empowered to appoint and dismiss the chief executive.
- 16. That institutes relate primarily to existing and emerging industry sectors rather than to specific disciplines.
- 17. That divisions and other operational research units work to mission statements with goals expressed in terms that allow their progress to be evaluated at predetermined points.
- 18. That the present statutory relationship between CSIRO and the public service board end.
- 19. That CSIRO pursue staffing policies compatible with its own objectives

which give management greater flexibility in setting terms and conditions of employment.

- 20. That CSIRO and the Department of Finance investigate amendments to the present superannuation scheme and/or alternative schemes which would improve mobility into and out of the organisation, and that the government then introduce the necessary changes.
- 21. That CSIRO adopt measures to encourage short term exchanges of staff with other public and private organisations.
- 22. a) That CSIRO increase the use of fixed term appointments for professional staff.
 - b) That new research staff without proven post-doctoral or other relevant experience be appointed initially to provisional fixed term appointments so that their ability can be evaluated effectively before they are offered indefinite appointment.
 - c) That CSIRO introduce an early separation incentive scheme where appropriate separation terms can be offered to research staff at management's discretion.
- 23. That the staff appraisal system in CSIRO contain adequate mechanisms for recognising achievement other than by publication.
- 24. That property rights to and income from inventions not subject to prior commercial agreement be divided between the inventors and CSIRO according to a formula to be determined by the CSIRO board, the overriding consideration being to promote the commercial development of the technology.
- 25. That the position title 'research scientist' be changed to 'research scientist/ engineer' and that research workers employed in such positions use that part of the title appropriate to their qualifications.
- 26. a) That CSIRO in co-operation with the universities and other degreegranting institutions increasingly make its facilities and research staff available for training research workers in areas where the Organisation offers particular advantages.
 - b) That CSIRO also play a role in technical training, especially where this assists in the communication of its work or provides for its own staff requirements.

Clearly, the final ASTEC report now contains some important new institutional directives. Despite Professor Birch's claim that "what is good in it is not new and what is new I don't regard as good",⁸ the report proposes a marked shift in the overall ethos of CSIRO from a science orientation to a strongly industrial alignment. This is reflected in its broad emphasis on applications oriented research in support of existing and emerging industry sectors, and in the proposed reorganisation of CSIRO institutes and divisions to relate, and work to, industry developments rather than to disciplinary interests. It is also reflected in the enlarged contractual links envisaged between the Organisation and industry, the emphasis on transfer of results to users, and, interestingly, in the new importance attached to the presence of

'research engineers', as well as research scientists, within the once scientifically elite institution. In the 'new CSIRO', if the proposals are found acceptable, it may well be that a research member will not have to 'publish or perish' but make a practical and innovative contribution to national needs!

The most significant reorganisation undoubtedly relates to the proposed replacement of the executive of CSIRO by an independent corporate-type board of directors empowered to appoint and dismiss the chief executive.

The Board should comprise a part time, non-executive Chairman, the Chief Executive and six non-executive members. It should be responsible for setting broad lines of policy and priorities in response to the policies and priorities of the Government, to the views of the broader outside community and to those of the Organisation itself.⁹

In the light of the great power built up historically by the executive and chairmen of CSIRO, this is change indeed and offers most promising institutional reform. The influence of CSIRO leaders in setting the agenda for research in Australia in the past has yet to be objectively evaluated. Professor Boris Schedvin's commissioned history of the Organisation has been long maturing and will doubtless shed much light; but historians are increasingly lighting upon evidence that illuminates the extraordinary dominance of CSIRO chairmen and the authority they have wielded in making, or breaking, lines of national research. These days are over. The universities are pressing their legitimate demands for a greater responsibility for basic research. This report offers them encouragement and a larger share in the pure research cake: at the same time its recommendation that CSIRO's chief executive combine "significant industrial experience" with distinguished scientific reputation, underlines a projected new tenancy of the executive suite.

Many of the recommendations touching on greater mobility for CSIRO workers and more active interchange between universities and the Organisation are echoes of the Birch report, but the suggestion that the central federal and state advisory councils and committees (set up as a result of Birch) be discontinued will prove controversial. Despite its array of national 'heavies', the advisory council, says the ASTEC report 'has found difficulties in providing advice on key policy questions and it has failed to have a significant impact on CSIRO's broad directions''.¹⁰ While this may tell us something about the executive, as well as an impotent advisory council, it is now considered that a changed CSIRO top management would be better served by the formation of smaller, more dispersed and specialist advisory committees for divisions, regional laboratories, and programs.¹¹

If ASTEC's 'second' CSIRO report, as some suggest, now embodies Barry Jones' 'hidden agenda', does it take reorganisation far enough? Should CSIRO be retained as a single statutory authority? Or will its monolithic structure continue to perpetuate a rigidity which new procedures and different kinds of personnel and management will find difficult to effect? The Churchillian maxim carries force. Huge organisations are not flexible and the report's talk of 'mechanisms' to link the colossus to industry sectors is unconvincingly vague. It seems to this reviewer that strong latches between existing and emerging industries — the thrust of the ASTEC report — might be more fruitfully achieved through bifurcation, tripartite or even greater division of CSIRO into several specific statutory authorities. Most importantly, one such section should be designed to take account of that hidden army of innovative talent, the individual inventor, who has always found difficulty in making links with CSIRO, yet, when properly aided, may be able to make a valuable contribution to new Australian technology.¹²

Sixty years on from the establishment of CSIR(O), the opportunities for reform of an outmoded institution are critical for Australia. The worst scenario would be for government to pass up the chance and allow CSIRO, with its strong institutional inheritance, to absorb the change and thus destroy the potential of a major advance in science and technology policy making.

Ann Moval

Honorary Editor

REFERENCES

- 1. OECD, Examiners Report on Science and Technology in Australia, Canberra, 1974.
- 2. Independent Inquiry into the CSIRO (Birch Report), AGPS, Canberra, 1977. See also Ann Moyal, 'The effect of institutional evolution on science policy' in A.T.A. Healy (cd.), Science and Technology for What Purpose? An Australian Perspective, Australian Academy of Science, Canberra, 1979, pp. 67-83.
- 3. Review of CSIRO's External Communication Activities, Vol. 1, Report of the Review Committee, CSIRO, Canberra, 1985.
- 4. Review of CSIRO's External Communication, Vol. 2, Community Perception of the CSIRO, management consultant's Report, November 1984.
- 5. Ann Moyal, 'Science advisory committees: national or self interest?' in Arthur Birch (ed.), Science Research in Australia: Who Benefits?, Australian National University, Canberra, 1983, pp. 29-33.
- 6. SCITEC, October 1985, p. 3.
- 7. Numbering 1-26 has been inserted for clarity. See ASTEC, Future Directions for CSIRO. A Report to the Prime Minister, AGPS, Canberra, 1985, pp. 1-11.
- 8. Quoted in SCITEC, January 1986, p. 8.
 9. ASTEC, op. cit., Summary.
 10. ibid., p. 5.

- 11. ibid.
- 12. cf. Stuart Macdonald, The Distinctive Research of the Individual Inventor, Working Paper No. 45, Department of Economics, University of Queensland, 1984; and Ann Moyal, Invention and Innovation in Australia: the Historian's Lens, Occasional Paper No. 1, Information Research Unit, University of Oueensland (forthcoming).