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Technological Innovation: Strategies for a New Partnership, *edited by Denis O. Gray, Trudy Solomon and William Hetzner.*
(North Holland, Amsterdam, 1986) pp.ix + 333, ISBN 0 444 70033 1.

This book offers a snapshot of American thinking on technological innovation in the mid 1980s: truly the mid 1980s because, although it is based on a conference held in May 1984, a good deal of the material is later than that.

It is worth serious study in Australia because, although the background and the causes are different, the effects — and the imperatives for action — are much the same. There is a sense of 'innovate or perish': perish, at least, as a country which offers high living standards to its people. In Australia, there is a painful awareness of the sharp worsening of the terms of trade. Other countries no longer want our traditional exports as much as they did, and short of major droughts in the northern hemisphere, that is not going to get better for us. In America, there is a chastened sense of the loss of technological leadership which runs insistently through these pages. There is a new wisdom of the east, as inscrutable and tantalising as the old: how does Japanese industry do it?

The urgency for action leaves little room for abstract theorising. None of the authors wastes much time contemplating the fundamental nature of technological innovation. There is an occasional, simplistic, half apologetic reference to the 'innovation chain', but the diagrams which all too rarely relieve the close print are not models of the innovation process: rather, they are models of organisations and institutional interactions. Collaborations, flows across boundaries, are the order of the day. Interfaces are the barriers to be overcome.

It is a mere retreat into agnosticism for George A. Keyworth, formerly President Reagan's Science Advisor, to emphasise basic research and the quality of science and engineering education. These things are the staple foods of technological innovation, not the revitalising injection which is being called for. Trudy Solomon and Louis G. Tornatzky, in their perceptive rethinking of the Federal Government's role, are more courageous. They argue that technological innovation is not primarily an investment problem but a problem of managing organisations and processes that transform knowledge. Government intervention can be effective to the extent that it can find high leverage niches to influence these processes.

The 20 chapters are ordered with admirable, if partly illusory, neatness into six sections. The first part deals with strategies, the second with policies and programs, and each part is divided into three levels, federal, state and industry.

Nowhere are there any easy answers. The National Science Foundation's (NSF) program to set up industry-university cooperative research centres does seem to have been a success. By 1985, we are told in a chapter by Gray and others, a respectable total of 29 such centres had been established, and five of them had become self-sustaining. But this is a game for heavyweights only: powerful research institutions coming together with companies in the Fortune 500, preferably in the Fortune 100. How many heavyweights can Australia muster to play in that league? And another question: do Australian authorities recognise sufficiently that such marriages are rarely made in heaven? They have to be worked at. Exhortation is not enough. The NSF gives a Planning Grant, a person-year to develop the concept of the centre and its research agenda, before an Operating Grant is considered.

William E. Souder is enthusiastic about research and development limited partnerships. These 'creatures born of US tax laws' provide arm's length relationships which may be attractive to universities. Moreover, Souder suggests hopefully, they may enable large firms to acquire the technology of small firms without inadvertently killing their vitality.

Faith in small companies is examined critically by J.D. Eveland. Yes, there is evidence that they generate new jobs and can play a role in the creation and the commercialisation of new technology; but also, as Eveland convingingly shows, they have a potent symbolism about them. Their power as a 'political icon' helped to overcome bureaucratic resistances to the introdution of Small Business Innovation Research programs in several Federal agencies.

Human resource issues have not until recently been given enough attention as a factor in technological innovation. Solomon and Tornatzky go so far as to call this 'a major unaddressed issue' as far as Federal Government efforts are concerned. In their broad view, process technology has been pushed too much into the background by emphasis on new high technology products, so much so that it is now the main area of 'obvious disadvantage' of the US relative to its competitiors.

It is good, therefore, to see four chapters devoted to human resource practices. Donald D. Davis concludes from his meta analysis that such practices can have a substantial impact on productivity and quality of work life, but remains doubtful about their effect on innovation. He must have radical innovation in mind, because the value of participative management in stimulating incremental innovations is well known.

The need for 'administrative accommodation' to the installation of advanced manufacturing technology is empirically demonstrated by John E. Ettlie from his study of 39 manufacturing plants: but 'accommodation' is a disappointingly reactive word. Surely it would be better to think of proactive planning of organisational change in parallel with technological change. James C. Taylor gives a neat case study of socio-technical system design in Zilog's semiconductor plant in Nampa, Idaho. Reactions to Nampa, he reports, vary from 'how can we have lived without it for so long?' to 'it can't possibly work, at least not in the long term'.

An impressive surge of activity at state level is documented by several examples. Michigan has created its Industrial Technology Institute, hoping that an 'Automation Alley' will emerge along the Ann Arbor — Detroit corridor. (What about the Sydney — Wollongong corridor? or the Melbourne — Geelong corridor?) Ohio and Pennsylvania have attached names to their programs: Thomas Edison and Ben Franklin respectively. From New York State, the Rensselaer Polytechnic Institute describes the 'RPI model'.

Much enthusiasm emerges from these descriptions. Pennsylvania has no less than twenty 'incubators' offering low rent and shared services to help entrepreneurs start up. But Edward E. David, formerly Science Advisor to President Nixon, sounds a cautionary note: not every state can realistically expect to duplicate the conditions that created California's Silicon Valley, the Route 128 complex in Massachusetts, or North Carolina's Research Triangle.

Don't miss the charming chapter by Marcia L. Rorke and Harold C. Livesay. ERIP, the federal Energy Related Inventions Program, has enriched the folklore about lone inventors with several more cases. The story of the wad of fibreglass blown by a breeze off a shelf into a beaker of citric acid solution, which surprisingly stripped it clean of resin, is worthy to take its place alongside the story of the *Penicillium* spore that blew on to Alexander Fleming's culture plate.

All this is fascinating and important stuff. The book gets alpha for content, but unfortunately gamma for presentation. The editorial standards are those of a random collection of emergency typists. Typos are legion. The print is smaller, and on some pages fainter, than a newspaper could get away with. Dealing with technological innovation demands far-sightedness, but exceptional visual acuity shouldn't be necessary. And this is presented in hard covers! It is a case of misleading packaging, and just as unacceptable as putting alcoholic coolers into fruit juice cartons.

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Structured Chaos: The Process of Productivity Advance *by Richard Blandy, Peter Dawkins, Ken Gannicott, Peter Kain, Wolfgang Kasper and Roy Kriegler.*
(Oxford University Press, Oxford, 1985) pp.viii + 111, $8.95, ISBN 0-19-554687-3.

At the beginning of the twentieth century Australia was one of the most socially and industrially advanced countries in the world. Per capita income was higher in Australia than any other country. Since then per capita income has generally increased, but not nearly as rapidly as in most of the older industrial countries of the northern hemisphere and the new industrial countries of east Asia. Today more than 25 countries have higher per capita incomes: Australia is falling further and further behind the rest of the world. This timely book investigates the reasons for Australia's relative decline and makes numerous suggestions for reversing this trend.