The Positive Sum Strategy: Harnessing Technology for Economic Growth
edited by Ralph Landau and Nathan Rosenberg
(National Academy Press, Washington, D.C., 1986) pp. xiv + 640, $35.00, ISBN 0-309-03630-5.

The National Academy Press leaflet announcing this volume claims that "Not since Sputnik have so many Americans been so keenly attuned to new developments in science and technology. Breakthroughs in communications, electronics, agriculture, transportation, and many other areas have transformed the American workplace and home. We live in an economy driven at an ever-faster pace by technological change. And the promise of technology sustains our economic future". Of course, American faith in technology has wavered in the past; and, as the concluding chapters of this volume dealing with the Japanese competitive threat make clear, there are both hopes and fears in present circumstances.

As one might expect from a joint venture of the US National Academy of Engineering, the Center for Economic Policy Research at Stanford University, and the Departments of Chemistry and Chemical Engineering at Stanford University, this is a handsome (and relatively low-priced) volume, which has been produced more quickly than most large collections of papers. Much of the material was originally presented at the Symposium on Economics and Technology held at Stanford in March 1985. This material comes from business leaders, engineers, economists and entrepreneurs and is said to provide "the knowledge available on the link between technology and economic growth and . . . .foresight into the major economic and technological policy issues that the United States faces in the next decade". It seems desirable, therefore, in this review to perform the librarian's task of setting down the entire contents:

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TECHNOLOGY AND INTERNATIONAL ECONOMIC COMPETITION

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All interests would seem to have been catered for. The authors were invited to consider the following overarching themes:

1. How technological innovation in the United States actually works in different industries and different forms of organisations and what future trends might be recognised.
2. How the United States innovative process compares with that of its principal competitors, especially Japan.
3. The comparative role of the educational, financial, and other key infrastructures in United States and competitors' economies as they affect innovation.
4. The impact of government on innovation, particularly from the standpoint of macroeconomic and microeconomic policies of the past and with regard to options for the future.
5. The competitive position of the United States in the light of the preceding analyses, and how economics and technology might work more constructively together to further this position and encourage healthy economic growth (p. ix).

For analytical content the reader should give priority to the early chapters by Rosenberg, Boskin, Jorgenson and Burton Klein and those from the

section on the economics of innovation by Kline and Rosenberg, Mansfield, Friedlaender and David. Taken together these constitute a more comprehensive coverage of US contributions to the microeconomics and macroeconomics of technological change and innovation than is available from any other single source. With the exception of two very interesting papers on the generally neglected relevance of the legal system to technological change, the policy, law, science, and education section does not break new ground. The papers in the final three sections tend to be shorter, except for Hannay's empirical studies of US competitiveness in seven industries (automobiles, electronics, steel, fibres textiles and apparel, machine tools, pharmaceuticals, and civil aviation manufacturing) and the concluding three essays of Okimoto, Aoki, and Landau and Hotsopoulos examining the Japanese challenge, which has come to dominate and distort a great deal of US thinking.

It is impossible to deal with more than a few of the issues raised in this important collection. In the event, the criteria of selection included originality and relevance to the Australian debate. First, the 'Macrorealities of the information economy'. Roach notes that 85 per cent of computers, other office machinery, and communications equipment were shipped to the US information sector in 1982. High tech investment and information-worker employment have gone hand in hand for more than a decade (p. 98). There has been "a dramatic convergence between these two components of the economy's overall capital: labor ratio. Over a span of 20 years, the stock of hightech capital per information worker moved from about half the size of its basic industrial counterpart to a position of relative parity in 1983. This trend, perhaps more than anything else, brings the information sector to the forefront of economic change in the United States" (p. 99). While Roach emphasises the potential vitality of the information economy, he sees also "a dark side": imports of high tech equipment have risen to over twice the level prevailing in late 1982 (p. 101). "The information economy may well offer a promise of renewed productivity growth, but at current exchange rates the resulting improvements in living standards could well turn out to be built on a foundation of foreign-produced and foreign-owned capital" (p. 101).

A second issue is the continuing habit of modelling the impact of science and technology as if the process were essentially a linear one. Baker, for example, wishes to accent "in every connection that physical science to which [he] attribute[s] so much of the base for the technology and economy of this age, is, in turn, heavily dependent on mathematics and the conceptions of logic and encoding that are the base for computers, analysis, and the treatment of atomic and molecular events" (p. 254). Overall, technology emerges as what makes the economy a positive sum game (Perry). There is some debate about the nature of the inter-disciplinary venture itself. Friedlaender expresses concern that the economists are still not paying enough attention to the insights of the technologists and engineers (p. 330). One might, however, go further and suggest that there is a general failure to integrate thinking about ways of organising with more conventional analysis of technological change and innovation. The insights of Kline and Rosenberg ('An overview of innovation') do not permeate the microeconomics of their economist colleagues, let alone the comments of business leaders, engineers,

technologists, and policy makers. The complexity of organisational structure and the process of organisational change tend to reduce quickly to the old big *vs.* small controversy and the lack of risk capital. Much more attention must be given to matters of internal organisation and modes of communication.

A third issue of special interest in the Australian context is raised by Kennedy, who asks to what extent utility should be sought in basic university research. He suggests the following spectrum of institutional solutions:

1 University as licenser, collecting royalties directly.

2. Separate corporation as licenser, developer, and supporter of research; no relation to university except through agreed sharing of royalty income.

3. Separate corporation as licenser, developer, and supporter of research; university faculty or administrators involved in governance.

4. Separate corporation as licenser, developer, and supporter of research; might also engage in final production. University faculty or administrators involved in governance; university has equity position (p. 272).

Australian administrators might note his contention that "nearly every major research university has a patent office and is active at level 1. A number have proposed or helped form special institutions, like that at level 2, through which research support could be undertaken on a venture basis and royalty income received by the university" (p. 272). He reports that "most universities have decided that levels 3 and 4 present problems of equity and conflict of interest that loom unacceptably large" (p. 272). His broad conclusion is that overemphasis on utility "can drain off the energies of the best scientists and sap the vigor of the university laboratories in which journeymen and apprentices work side by side at the bench" (p. 273).

Quinn addresses another issue that has been accorded far too little attention in Australia. He challenges the widespread view that technology is not readily applied in the services sector and asks about the potentially profound impacts of services technology. "Will an 85 to 90 per cent services economy in the United States develop an unacceptable dependency on the outside world for the raw materials and manufactures we consume? Or will a lively international trade develop for services as it did in the past for manufactured goods and materials? Can a nation develop a comparative trading advantage. . . . through service technologies?" (p. 371).

Like the valuable journal, *Issues in Science and Technology,* which emanates from the same source and is a joint venture of the National Academy of Engineering, the National Academy of Sciences, and the Institute of Health, this volume is of interest to many outside the primary audience of engineers and economists. There is no Australian equivalent. The joint Australian Academies effort, *Science and Technology For What Purpose? An Australian Perspective,* 1979, is already dated and never reached the overall level of competence of this new US publication. This creates a dangerous situation. There can be a strong tendency to adopt the US analysis and apply its results in the rather different Australian circumstances. Readers should

note that, at most, two of the 43 contributors to this volume can be regarded as not located in the US. A more positive response would be to resolve that there should be an Australian equivalent and to set about its production. There would, however, be a resource constraint: Australia lacks both sufficient awareness of the positive sum strategy and the knowledge of the processes of technological change and innovation that now characterise the US. This is not to imply that US research has yielded all the answers and policy guidance needed. It is possible, however, that their present fears will shape research to seek those answers and guidance.

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The Electronic Estate. New Communications Media and Australia *by Trevor Barr*
(Penguin Books Australia, Ringwood Victoria, 1985) pp. 271, $8.95, ISBN 0-14-008006-6.

After a deep, initial silence, a number of books — Ian Reinecke and Julianne Shultz, *The Phone Book* (Penguin, 1983), my own *Clear Across Australia. A History of Telecommunications* (Nelson, 1984, 2nd ed. 1985), Reinecke's *Connecting You: Bridging the Telecommunications Gap* (Penguin 1985) and now Trevor Barr's *Electronic Estate* — have burst upon the scene and provide a fairly substantial cover of telecommunications in Australia.

Within this quartet, Barr's work is an attempt to offer an overall view of Australia's contemporary internal and overseas telecommunications services, to examine the importance of our expanding information economy, and to consider the political and economic complexities of communications media in Australia. His title is well chosen. After the historical 'estates' of parliament, the church, and the people, the 'fourth estate' of the press, and the 'scientific estate' nominated during the period of science euphoria in the fifties, electronic communication and the dynamic, pervasive information society it has generated, can, it would seem, legitimately be elevated to the status of an important new national 'estate'.

Barr, senior lecturer in Media Studies at Swinburne Institute of Technology, Victoria, moves across a broad landscape in Australia which he sets against a selective international scene. His early chapters range over questions of multinational dominance of electronic and telematic industries in Australia, deskilling and the nature of work in telecommunications, decision making for telecommunications by public inquiry, government and party attitudes to telecommunications technology, and the failure of our national technology policy. His later chapters are more cohesive. In these he addresses broadcasting and telecommunications ownership and services, the domestic satellite and its governing AUSSAT, and the emerging new networks of cable television and videotex services. His method is allusive. The book, however, is highly readable, and as I know well, it is extremely difficult to trap and organise information in this dense, complex, and frequently overlapping field.

The particular strength of this book lies in the questions it poses. Centrally Barr is concerned with the nature of policy making for telecommunications in