What I would have liked to see is more on the experience of Asian nations. More papers along the lines of that of Radzi Mansor outlining the telecommunications experiences of specific Asian/Pacific countries would have provided a good backdrop to a useful dialogue between the regional managers and their Australian and developing country counterparts. In particular, the section on an international perspective could have benefited from an overview of telecommunications development in the Asia/Pacific region. This was conspicuously missing from Brian Brogan's discussion of trade and commercial patterns in the region. Kevin Casey from his manufacturer's view point did provide some brief glimpses of interesting developments in the region.

I'm not sure what the regional managers would have gained from the papers on data protection and privacy, the dynamics of management teams and so on. From the point of view of a person who has struggled to make telephone calls in one of the lesser developed countries of the region, many of these issues covered in this set of conference proceedings seemed ludicrously irrelevant.

In the end I'm not sure that I agree with Tim Nulty and the World Bank. I think that provision of suitable infrastructure and increasing the penetration of sophisticated telecommunications throughout the region is much more important than industry structural arrangements. It is this procurement role which will continue to be performed by national governments and international agencies like the World Bank. As Nulty points out in his single footnote, "Telecoms are too critical an infrastructure to be left entirely to the 'markets'".

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Logic and Information *by Keith Devlin* (Cambridge University Press, UK, 1991), pp.xii + 307, $39.95, ISBN 0-521-41031-4.

Keith Devlin is Carter Professor of Mathematics at Colby College, Maine. As a specialist in mathematical logic, he became interested in questions connected with information processing. This book was written largely during a two-year period in the late 1980s at the Center for the Study of Language and Information at Stanford University.

What is the relevance of such interests for the research and policy discussions that feature in *Prometheus*? Science and technology are both information and we are accustomed to the assertions that S&T have a vital role in economic growth and development. The emphasis is usually placed on the positive, stimulative effects, rather than on the dangers; and as Michel Menou suggested in his paper for the 1993 International Information Research Conference in France last July, the linkages between information investments and the achievements of specific development goals are far from self-evident.

Devlin begins by harking back to John von Neumann's 1949 speculations that "we are not too far from the limits which can be achieved in artificial automata without really fundamental insights into a theory of information". Of course, it was also von Neumann who long ago drew attention to the shift of science away from the concepts of energy, power, force and motion, to concern with problems of control, programming, information processing,

communication, organisation and systems. For so doing, he should rank with others who foresaw the growth of the modern information-intensive society.

Clearly these questions call for interdisciplinary efforts. The Stanford CSLI involves researchers from computer science, artificial intelligence, linguistics, philosophy, mathematics and cognitive science. Unlike that other American venture, the Santa Fe Institute with its Studies in the Sciences of Complexity, CSLI does not appear to include economists.

In what is rightly claimed to be a provocative and ground-breaking book, Devlin puts the view that the deeper understanding of the nature of intelligence and knowledge acquisition requires changed concepts of both logic and information. His focus is not on mathematical truths but on ordinary inference and the flow of information. I recall economist Stiglitz's reminder that economic research has yet to model an economy in which information is *continuously* begin collected and processed and in which decisions, based on that information, are *continuously* being made.

Devlin asserts the importance of information, believes we can side-step the question "What is information", and focuses on "the nature of information flow and the mechanisms that give rise to such a flow" (p.2). Two distinctive features of his effort are the concepts of an *infon* and of *situation*: "an 'infon' may be thought of as a discrete item of information and the word 'situation' may be understood in its normal, everyday sense. to refer to some part of the activity of the world..." (p.11).

Constraints such as natural laws, conventions, analytical rules, linguistic rules and empirical law-like correspondences, make the information flow possible, their role being conveyed by the word *means*.

Devlin is building on Dretske's ideas about analog-digital conversion, distinguishing two stages in the extraction of information from the environment: perception and cognition. His concern seems to lie with the conceptual information stage, the agent being assumed to have the capacity of cognition.

We should be grateful to the CUP editor who changed this book from a textbook style to one more accessible to a much wider audience. Devlin is striving for fundamental insights that are needed not only in the areas of new science delineated by von Neumann, but also, for example, in the information economics around which economics generally must be built.

A short review does not permit development of these ideas but a couple of illustrations can be given. First, "capability" is an fairly standard term in economic development, when we are attempting to specify the conditions in virtue of which endogenous technological change can occur. I should like to think that a better theory of information would be helpful; improvement might come from recognition that both Devlin's treatment and development theory seem to lack a capability concept.

Second, we might ask to what extent the *constraints* are subject to economic influences. The direction of effort here might be illustrated by one or two cases of trespassing: Jacob Marschak's economics of language and George Akerlof's enriching of economic models with psychological, anthropological and sociological factors.

Such research questions may well be pursued in the environment of the Stanford CSLI or the Sante Fe Institute, but not in a university system that

judges "any intellectual pursuit in terms of its immediate cash value" (Devlin, p.viii). I leave to the reader the judgement about potential Australian locations.

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Research and Technology in Tropical Australia: Symposia, *ASTEC Occassional Paper No.23*, (Australian Government Publishing Service, Canberra, 1992), pp.viii + 115, ISBN 0-646-12377-7.

Consultation has been the hall mark of ASTEC's work program. Attempts have been made to consult extensively in preparing as well as in discussing Occasional Paper No.23. Not only have these consultations taken place in various parts of the tropics, including Perth, Brisbane, Cairns, Townsville, Darwin, Katherine, Kununurra and Jabiru, but these consultations have also included various government departments, agencies, industry, higher eduction and community groups. The Paper is a part of the outcome of this extensive consultation process. It contains ideas and views about Research and Technology in Tropical Australia. The focus of the study is the area "north of the Tropic of Capricorn and comprising the wet, wet/dry and dry tropics and maritime area".

This paper must be considered for what it is. It is not a document containing final findings. It is what can justifiably be called an "input" document. The preface of the book details the objective: "To inform and stimulate discussion ...., ASTEC commissioned a number of papers which review research and technology in various fields." (p.iii) It fits in well with the terms of reference of the ASTEC's study into Research and Technology in Tropical Australia. Therefore Paper No.23 should be seen as a glimpse of an ongoing process.

Because of the tentative nature of this document, the review presented here in all fairness needs to be restricted to (a) how the paper fits into the processes that have been undertaken by ASTEC's working party and (b) how novel and effective the ideas contained within the paper seem to be.

If it is to be judged on the basis of the responses it elicited, there have been well over a hundred written submissions. A number of themes emerge from these submissions. Some of these include formation of networks at local, national and international levels; concerted exploitation of research and technological opportunities emanating from geographic proximity to Asia, Southeast Asia and the Pacific; sustainable funding for providing infrastructure for carrying out research and development in the tropics; appropriating research to some of the perceived inherent characteristics of the area, namely the "Tyranny of Distance" and to the Aboriginal and Torres Strait Islander communities. However, if the occasional paper, is to be evaluated as an opportunity for bringing together either new and fresh approaches or voicing genuine concerns about research and technology in tropical Australia, the "jury is still out". It is one thing to be consulted but quite a different issue as to how much of the consultation will actually be incorporated into the final deliberation. The problem is going to be one of bringing together and managing the consultation, especially bearing in mind the breadth and depth of the material contained. The task at