some trenchant comments by Nobel prize winner Peter Doherty. For Australian science to remain competitive internationally, some hard decisions will have to be made about where the research dollars are to be placed. At the same time, sensible choices must be made about the extent to which, and the fields in which, Australians attempt to originate technology, as opposed to importing and adapting it.

These are not decisions which can, or should, be left to the board and management of CSIRO to make. But they require a much more technologically aware political community than we have yet been able to assemble in Australia.

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The Diffusion of Information Technology: Experience of Industrial Countries and Lessons for Developing Countries, A World Bank Discussion Paper, No. 281

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For those basically familiar with Everett Rogers' *Diffusion of Innovations*[1] and other related literature on the topic, this book, at first glance, would seem nothing more than the usual discussion of the standard precepts underlying transfer of technologies. But the book is more than that. The authors,[2] renowned experts in the field of informatics, selected the best practices of eight industrial countries—Canada, Germany, Ireland, the Netherlands, Sweden, UK, USA and Japan—in information technology (IT) development and diffusion for possible adaptation to the conditions of developing countries.

The book expounds on national policy portfolios and diffusion programmes in the rapidly growing IT industry over the past 10 years. With critical insights and analysis of government policies and experiences in technology transfer programmes, the book provides practical guidelines for designing IT diffusion programmes complemented with box articles and diagrams highlighting trends and developments in the industry.

Notably, there was a gradual shift in policy from IT promotion to diffusion since the late 1980s among industrial countries. This shift, from upholding 'national champions'[3] to assisting small and medium-sized enterprises (SMEs) to adopt available IT, was brought about by the increasing realization that the country can reap more political and economic benefits if efforts are directed to its widespread use. The UK, for example, has had a wide range of policies supporting IT generation and diffusion. For several years there was a 'Buy British' policy programme, but this was changed in the 1980s when the government decided to intervene less in the country's industrial structure. In the 1990s, however, strategic attempts to nurture both IT generation and diffusion were made through bridging programmes that would link producers with users and support skills transfer and manpower development, standardization and infrastructure investments.

The authors rightly point to this trend. In such an interdependent and so to speak interconnected world nowadays, countries cannot afford to remain insular. Outward-looking strategies need to be adopted to stay in line with the changes in world economy. Years ago, it would have been unthinkable for companies in industrial countries to set-up

production sites abroad, believing that products 'Made in the USA' or 'Made in Japan' are of superior quality and will remain so in perpetuity. But with the rising cost of raw materials and labour, they are left with no choice but to invest in other countries, establish subsidiaries and joint ventures with local and international business groups, and strengthen linkages with R&D institutes to reduce innovation costs and facilitate diffusion of pioneering technologies.

Indeed, IT has modernized basic infrastructures and enhanced national productivity in key industries and services. IT, being a generic technology, is easier to adopt with the convergence in computing, communication and multimedia technologies. The government and private sector alike must keep pace with IT developments to be able to compete in the global market-place. Its importance is reflected in the evolving national information infrastructure (NII) plans in both industrial and developing countries leading to a global information infrastructure (GII).[4] Focusing on the UK as a case study, the country has developed IT strategic planning through the so-called 'technology watch' and 'future looks' to monitor key developments in the industry, coordinate the works of government line agencies and pool mutual resources towards identifying priority policies and future IT needs. Developing countries may well succeed the UK model in formulating NII policies and programmes.

While one would normally think that technology diffusion is about hardware and software, the authors stress that it is about users. Agreeably, technologies are developed with the users in mind, and since experience shows that user-friendly technologies have a higher rate of adoption, user needs, priorities and capabilities should be taken into consideration in designing and diffusing IT programmes. Of course, not to be taken for granted are the existing conditions (i.e. policy environment, technical knowledge and skills, market demand) that should be studied prior to IT programme design and delivery. As the old proverbial saying goes, 'It's not what you don't know that kills you. It's what you think that you do know'. Hence, it is wrong to assume that success in one area ensures replicability in another.

Citing the experience of Ireland's C*STAR, the project assumed that consumer behaviour in the affluent 'telephone society' of Denmark would reflect consumer behaviour in a relatively poor rural Ireland. Characterized primarily as a 'technology push' programme, C*STAR had limited impact as the introduction of videotex and database in Ireland's rural communities failed to harmonize with local needs and interests.

The authors, thus, aptly underlined the importance of letting technologies *'mature'* instead of forcing the adoption of available IT products. It took Ireland 10 years, for instance, to successfully diffuse computer-aided design (CAD) tools in manufacturing industries promoted in the 1980s by several European governments. The users' technological sophistication and exposure to international knowhow and the introduction of incremental rather than radical changes should be carefully considered.

Further emphasized is the need for partnership between government, private sector and aid agencies. Since 'technologies walk on legs', networking among these and various other institutions (i.e. universities, research centres, consultancy firms) can tap on already available expertise and hasten the diffusion process. Training and education will also build up local capacities to undertake and manage IT programmes and improve their international competitiveness in the field. Other integrated support service packages including incentives, cost-sharing, pilot testing, periodic technology audit and regular project monitoring and evaluation are likewise crucial to encourage IT adoption and speed up diffusion.

In sum, the book outlines broad directions in which developing countries may

proceed with IT diffusion using the diverse experiences of industrial countries. Essentially, effective diffusion programmes should address needs for technical information, human capital, research and development, finance and coordination among relevant agencies. Governments should provide the policy framework for IT generation and diffusion while private businesses should spearhead the growth and development of the industry with focus on assisting SMEs in adopting available IT goods and services. Donor agencies should support public-private collaboration in planning and implementing IT projects.[5]

In this information age, countries must remain at the forefront of technological innovations Whoever holds information has power, hence countries must build on their IT capabilities and information networks at home and abroad. Domestic policies should thus be designed in such a way that national technological competency is harnessed and open links with the international business community are maintained. By learning and leveraging from the experiences of industrial countries, developing countries can use tested approaches and mechanisms thereby avoiding the common pitfalls in the pursuit of technological advancement.

Cautioning against the 'appropriate technology trap', the authors heeded that developing countries need not adopt 'less advanced technologies than were available in industrial countries.... In certain respects this was undoubtedly useful [but] when applied to sectors of the economy exposed to international competition ... the "appropriate technology" argument is a prescription for institutionalizing competitive disadvantage.'

Given the disparities between industrial and developing countries, it may seem impossible for developing countries to 'catch up' with their industrial counterparts. But as the New Industrializing Economies (NIEs) have proven, it is possible to leapfrog the experiences of large industrializing economies in IT use. With such a pervasive technology as IT, developing countries cannot afford to be left behind. With the right policy mix and programme combinations, as the authors suggest, developing countries can try to maximize the benefits from IT since what matters most in this information society is the ability of countries to use information to advance themselves.

Admittedly, the book does not aim to be exhaustive or comprehensive. As the authors state, 'it is not intended to provide blueprint plans or country-wide specific assistance packages. The study focuses on a few relatively visible [IT] programs in each of the selected Organization for Economic Cooperation and Development (OECD) countries.' The study, nevertheless, 'draws on the substantial tacit knowledge of practitioners, extensive reviews done by [the authors] and by various program managers and independent evaluation teams of OECD over the last decade'.

What could perhaps be relevant to the study, but is not covered in the discussion, is the implication of IT diffusion on intellectual property rights (IPR). With calls for a more open and accessible global marketplace, issues relating to patents, copyrights and trademarks have increasingly cropped up with industrial countries, more often than not, accusing developing countries of IPR infringements. Also, given the differences in culture and levels of economic development between industrial and developing countries, it may be worthwhile to study the impact of IT diffusion from industrial countries on labour, management and organization policies and practices of developing countries.

Finally, whereas the focus of the study is made on OECD member countries, the experiences of Asian NIEs—namely Hong Kong, Singapore, South Korea and Taiwan which have made significant breakthroughs in IT and are now heavy competitors of industrial countries—would be an interesting read.

Notes and References

1. Everett Rogers, *Diffusion of Innovations*, Free Press, New York, 1983. The central point of the diffusion theory is that innovations which show relative advantage, compatibility, trialability and observability have a better chance of adoption and that the rate of adoption would be faster with sustained assistance.
2. Nagy Hanna is the principal operations officer in the World Bank's West Bank and Gaza Resident Mission. He is also author of several IT-related World Bank Discussion Papers. Ken Guy and Eric Arnold are directors of Technopolis, Technology Policy Consultants in Brighton, UK.
3. National champions refer to companies such as Siemens in Germany, Ericcson in Sweden, and Philips in the Netherlands which are a major source of national innovation and technology.
4. The GII concept was first proposed by US Vice-President Al Gore in his speech during an International Telecommunications Union (ITU) Conference in March 1994 in which he called for all nations to build a network of telecommunications systems, so-called 'information superhighways', that 'will allow [nations] to share information, to connect, and to communicate as a global community'.
5. The World Bank's Information for Development (*info*Dev) initiative provides technical assistance to countries in formulating national information infrastructure policies and plans and encourages private sector participation in government-supported IT programmes.

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Local Matters—Perspectives on the Globalisation of Technology

John Phillimore (Ed.)

Perth, Western Australia, Institute for Science and Technology Policy Murdoch University, 1995, xii + 186 pp., AU$ 15.00, ISBN 0 8690 5411 2

This book is a collection of papers from the doctoral programme in Science and Technology Policy and Socio-Economic Progress (STEP), presented at the STEP meeting of September 1994. The idea to combine and to publish the work of PhD students and experienced researchers is an excellent one since it clearly shows how research is developing and which topics are focused on the younger generation of scientists. The authors and editors have to be congratulated for this idea and it would be good to see more of this.

There is a total of 36 papers in the book (including an introductory paper by Keith Pavitt), divided into four main categories which all deal with the globalisation issue, though from different perspectives. One chapter is titled 'Research, Technology and Industry', a second one is headed 'Ecological Sustainability'. The two other chapters cover 'Country and Regional Perspectives' and 'Philosophical and Historical Reflections'.

The 13 papers on Research, Technology and Industry cover a very broad scope of different topics from sector globalisation analysis (Lofgren on the pharmaceutical industry and Morrigan on Medical Technology) to system theory (Barker and also Nash). The latter question is one of increased interest in the process of the intensifying internationalisation and globalisation of markets due to the fact that markets move closer to each other and thus new elements are added to existing systems and new relationships arise. New technologies imply that knowledge and information about foreign countries and markets are spread around the world immediately, thus affecting decision makers in