The Role of ICT in Australia's Economic Performance*

Gary Banks

Chairman, Productivity Commission

Considerable uncertainty hangs over the world economy at present, from which the Australian economy is not immune. While the future must remain uncertain, what does seem clear is that Australia's growth performance over the past decade has been exceptional. By the September quarter last year, Australia had notched up nine years of growth averaging 4 per cent annually. This included a dozen consecutive quarters of through-the-year growth of above 4 per cent – the longest run of such growth since the quarterly National Accounts commenced in 1959. In the same decade, the average incomes of Australians rose by 2.5 per cent a year, one percentage point above the previous trend.

This growth performance was all the more remarkable for having withstood the financial crises which gripped our major Asian markets – an achievement for which it is hard to find parallels in our previous history, or that of many other countries. Indeed, Australia stands out as one of only a few countries to have significantly improved its growth performance in the turbulent 1990s.

Another such country was of course the United States. In both cases, a major proximate source of higher growth was a surge in productivity (the ability of industries to get a bigger output payoff from the physical and human resources available to them).

The productivity acceleration in Australia started earlier and, by the Commission's reckoning, was much more pronounced that that of the United States. However, the US uplift has generally attracted more attention, partly due to the importance of the US economy, but also because it appeared unexpectedly – at a stage in the business cycle when a *slowdown* in productivity growth would normally have occurred. It

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also coincided with an acceleration in investment in rapidly advancing information and communication technology (ICT) and the uptake of the Internet.

This has been conflated in popular economic commentary as the 'new economy' phenomenon. The concept is rubbery and has had many expressions. The more respectable versions see developments in ICT as having wrought changes within and among organisations that have allowed key industries to grow faster, and thus the economy as a whole to grow faster and with less vulnerability to inflationary pressure. Some have gone a fair bit further, foreseeing endless growth and the abolition of the business cycle. These more extravagant claims have recently been punctured by the setback in technology stocks and growing signs of economic downturn in the USA. Nevertheless, the linkage of ICT to improved economic performance in the USA remains at centre stage and is generally seen as a positive development for the future of the US economy.

Australia's productivity performance, on the other hand, has been downplayed in some quarters as 'old economy' stuff – holding less hopeful prospects for the future. Despite some initial scepticism it is at least generally recognised that there *has* been a surge in Australia's productivity. And it is now also generally accepted that this has had much to do with the wide-ranging program of microeconomic reform in this country over the past decade and a half. But some have seen this as involving only one-off gains from eliminating waste and inefficiency – a temporary boost to our productivity, lacking the technological drivers needed to sustain the productivity performance of a 'new economy'.

I believe that this interpretation sells our achievements short and is unduly pessimistic about our economic prospects. For one thing, the heightened incentives and disciplines for improved performance are not temporary. The reductions of barriers to competition and removal of impediments to innovation can be expected to have lasting effects on the dynamism of our economy. And, to the extent that the economy has become more flexible and adaptable, its capacity to deal with external shocks in the future will have improved.

Further, recent Commission research has shown that the reforms have not only driven out many sources of inefficiency, they have also provided the motivation – and the capacity – to make effective use of new technologies, including ICT. Indeed, research by Commission staff, soon to be released, finds Australia's growth experience in the 1990s to have more in common with that of the USA than has previously been recognised. It also lends support to the findings of the OECD's own recent international research that it is how effectively the new technologies are *used*, not the extent of their domestic production, which is the dominant source of benefit.

ICT as an 'enabling technology'

It doesn't require much imagination to believe that the new ICTs have considerable potential to raise a country's economic performance. At a personal level, we can all think of improvements in our lives that these technologies have brought. The one that first came to mind as I was writing that sentence is the ability to use my plastic EFTPOS card not only to avoid bank queues in Australia, but also foreign exchange queues in countries like France or Italy (which specialise in long ones). Another – more questionable – benefit is the ability of my office to stay continuously in touch with me (by mobile phone) and to keep me topped up with voluminous reading matter (by fax or email).

These random examples point to a defining feature of ICTs, in terms of their potential influence. They constitute what economists call 'general purpose' or 'enabling' technologies. As the names suggest, these are technologies which are of general application; technologies which provide a platform for many other innovations – and hence technologies which can have pervasive economic effects.

According to the eminent Canadian economist, Richard Lipsey (who spoke on these matters at an ANU conference recently) there have been only a dozen enabling technologies developed over the course of human history. And ICTs – more specifically, electronic computers and the internet – are the only enabling technologies to have emerged in the last century.

This interpretation of the role of ICTs is important, because the major waves of accelerated growth through history have generally been related to the introduction, evolution and dissemination of enabling technologies. While the advent of the steam engine fuelled the first industrial revolution in the United Kingdom (1760-1830), Robert Gordon, from NorthWestern University, attributes the second industrial revolution – the American Golden Age (1913-1972) – to a suite of enabling technologies invented 20 to 50 years before then – including electricity and the internal combustion engine. The interesting question now is whether the ICT revolution is the harbinger of a third industrial revolution.

How ICTs can raise productivity

The particular contribution of ICTs to economic performance comes from their ability to reduce radically the costs of storing, accessing and exchanging information.

Such transaction costs have been estimated by American researchers as amounting to over 40 per cent of the value of national income in that country (North, 1990), so the potential for economic gains from their reduction would seem considerable.

There are a variety of avenues for ongoing efficiency gains. Some involve improved production processes within individual firms. Just as electricity enabled development of the continuous production line processes that Henry Ford used to such effect, the decentralised availability of information through IT allows the reduction of hierarchical structures within firms and greater empowerment and capabilities for work teams and individual workers, who can do their own monitoring and make their own adjustments to production – and reap the rewards through performance-based remuneration systems (themselves IT-based).

ICTs also allow more lean and timely inventory management, as sales data is continuously and accurately monitored and communicated; in turn transforming relations between firms and their suppliers.

ICTs can also transform a firm's relations with its *customers*, providing (among other things) increased scope to tailor products to individual requirements. (It is perhaps not surprising that a pioneer in this area has been an entrant to the IT sector itself – namely Dell.) And consumer sovereignty is enhanced by the ability of consumers to scan markets more quickly and effectively over the phone line – either directly or via the internet.

The internet, an enabling technology in its own right, has dramatically enhanced the efficiency of searching for information of all kinds – not just goods and (proliferating) services, but also investment opportunities and jobs. It is notable that the Commonwealth Government's Job Network, which the Commission is currently reviewing, is the fourth largest online business in Australia. Online job searching can be far more efficient because it can be interactive, is always available, includes more information and avoids labour costs. For example, 7-ELEVEN convenience stores offer job applicants an initial electronic interview, which has improved matching and increased their retention rates. From an economy-wide perspective, better matching should both lower unemployment and increase productivity.

A similar efficiency gain is realised in share portfolio choice, stemming from the informational superiority and low transaction costs of online methods. In the United States, on-line trading already accounts for over one-half of all retail trading in equities and options.

Moreover, the on-line delivery of entertainment and information services can be achieved at an incremental cost to the supplier of close to zero – contrasting with the significant costs of producing and distributing books or CDs or even software.

This allows new ways of distributing content that become more viable as bandwidth costs plummet. For example, in the UK, YesTV is using British Telecoms DSL service to stream over 1000 Hollywood movies to subscribers. According to a study by Ernst and Young, where people acquire broadband connections, overall demand for content services appears to increase by about 20 per cent.

While these benefits are typically analysed and discussed against the backdrop of the US economy – the technology leader – they are clearly relevant to our own economy as well.

Australia *is* an advanced ICT user

The average expenditure on ICT goods and services by Australian businesses and households surged in the 1990s. ICT expenditure as a percentage of GDP increased from just under 7 per cent in 1992 to just over 8 per cent in 1997 – well above the OECD average and exceeding even the USA (7.8 per cent). While annual investment growth in ICT through the 1990s, at 15 per cent, was slower than the USA (18 per cent) it was again higher than in many other countries.

Business use of ICTs in Australia, relative to the OECD, is at a "medium to high" level, with three-quarters of all businesses using computers in the workplace, the majority with internet access. In terms of usage of secure web servers for electronic commerce, Australia is number three.

By OECD standards, the use of ICTs by households in Australia also scores well. In 2000, 50 per cent of all Australian households owned computers, comparable to the USA. And internet users as a proportion of the population, at around 30 per cent, is only slightly lower. That said, the proportion of Australian households with internet connections, while on a par with countries like the UK, is significantly lower than in the USA.

A summary index of ICT infrastructure, developed for 55 countries by International Data Corporation, ranks Australia 8th in the world, compared to America's 4th position (with the Scandinavians on top). Notably, Australia makes it into the top three in computer and internet infrastructure, next to Sweden and Singapore, whereas the USA was ranked tenth in this combined category.

Where Australia is clearly outdone by the United States is in the *production* of ICT equipment. In 1998-99, Australia's ICT sector (equipment and services) accounted for only 4.1 per cent of business sector value added – well below the OECD average and less than half that of the USA as a leading producer of ICT equipment.

Is lack of ICT production a problem?

Does this matter? The OECD came to the conclusion, in its major cross-country study, *The Growth Project*, that it does not. In its words:

> "ICT is important for growth but having an ICT-*producing* sector is not a pre-requisite."

The previous discussion of the transforming potential of ICT as an 'enabling technology' would also suggest that it is in achieving effective use of these technologies that many of the gains in efficiency and productivity are to be derived.

This is not to deny that there may be some useful synergies between production and use, or between producers and users of ICT. For example, as Harvard's Michael Porter has argued, sophisticated customers may foster the development of more sophisticated production, and the reverse is also possible.

However such potentialities need to be placed in perspective. As the OECD warns:

> "… only few countries will have the necessary comparative advantages to succeed in ICT output."

In its 1998 Inquiry into *Telecommunications Equipment, Systems and Services*, the Commission found that the international pattern of revealed comparative advantage in telecommunications and internet use per inhabitant suggested, if anything, a *negative* correlation between intensity of use and manufacturing capability (IC, 1998, p88-9). International comparisons demonstrate that a country can have thriving and efficient telecommunications *services*, without domestically manufacturing the constituent parts (and vice versa). Australia is of course already an example of such a country.

While at that time, the Goldsworthy Report had advocated government support for ICT production – and semiconductor manufacturers like Intel were playing very hard to get – the Cutler Report was perhaps more prescient in observing that the most important aspect of ICT had shifted to content and information management, away from hardware production.

In the event, the extreme competitiveness within the ICT sector has seen equipment prices fall like a stone since the mid-1990s – and with them the share prices and workforces of some of the leading manufacturers (like Ericson, Lucent, Alcatel and Fujitsu) which have been restructuring and closing down plants. Intel, the icon of the ICT industry, has seen its share price fall by about 65 per cent over the past year.

The fall in ICT prices has been greatly to Australia's advantage – as a predominantly importing country – helping raise our terms of trade and boosting the real income of Australians. The dramatic fall in ICT prices also helps explain the recent rapid growth in investment in ICT capital goods.

Measuring ICT use in productivity performance

Preoccupation with the manufacturing side of ICT in Australia was given some renewed impetus by the US economic boom. This was fostered by analysis in the USA that attributed a large part of the acceleration in productivity in that country to gains within the ICT sector itself.

However, there is now growing evidence that there has also been an acceleration in productivity in US industries outside the ICT sector – particularly those with more intensive use of ICT.

A forthcoming Commission research paper reveals some parallels between the United States and Australia in the links between ICT use and productivity performance.

For one thing, our research finds a comparable upswing in the use of computers and related equipment in the two countries, reflected in the timing and magnitude of ICT 'capital deepening' (the amount of equipment relative to labour used in production).

It also appears that, in both countries, ICT equipment has been displacing other forms of capital.

The United States productivity acceleration was found to be much smaller than Australia's, when comparable methodologies were used.

Australia's productivity acceleration cannot be attributed to gains in the ICT sector, given the relative insignificance of our IT production. The fact that the productivity surge was stronger than in the USA, however, suggests that any shortfall in an ICT manufacturing contribution was more than outweighed by greater benefits from ICT use than in the USA (perhaps because Australian firms had to 'catch up' to their American counterparts) or because Australia has benefited more from other sources of productivity improvement unrelated to ICT. Determining the relative importance of these requires detailed research into the relevant individual industries, but some early evidence is suggestive.

Complex interactions are involved

Productivity growth rates estimated by the Commission for Australian industries show the strongest acceleration since 1994 to be in wholesale trade, and finance and insurance, eclipsing the traditional strong performers – including the public utilities in the early post-reform years. The new contributors in Australia have coincided with the better productivity performers in the United States – and they are relatively intensive users of ICT.

The case of wholesale trade is particularly revealing. Its major turnaround in productivity performance in the 1990s – outstripping all other industries – led the Commission to undertake a detailed case study of its experience.

What we found was that IT had indeed facilitated a transformation of wholesaling performance. It wasn't that wholesaling businesses had necessarily gone overboard on IT spending, but their use of IT – particularly bar-coding and scanning technology which provided accurate electronic records all along the supply chain – had enabled them to streamline their processes, reducing the need for storage and handling. In other words, ICT had facilitated productivity gains through new processes and business restructuring.

These gains did not just happen, however; a precondition for realising the necessary changes that produced them was the greater enterprise flexibility and autonomy that had come from reforms in labour regulation, including through the introduction of split shifts and reduced demarcations.

This accords with the experience of most enabling technologies, which have limited applications and impacts initially, and do not really make their mark until organisational structures and institutional arrangements have been adapted to accommodate them. As Lipsey shows, during this evolutionary process advances are made in the technology itself, new ways of using it are found, and new products emerge that would have been impossible without it.

This is likely to remain the biggest source of economic gains from ICT for some time yet. The authors of an important recent review of US micro studies of IT use noted:

> "As computers become cheaper and more powerful, the business value of computers is limited less by computational capability and more by the ability of managers to invent new processes, procedures and organisational structures that leverage this capability." Brynjolfsson & Hitt (2000, p24)

The culmination of this evolutionary process is the potential for spillovers, network economies or so-called 'synchronisation' gains from interactions *among* a critical

mass of users of the technologies. Arguably the most important manifestation of that in ICT is the application of computers to e-commerce, via the internet. As noted, while Australia's ICT investment is still building up to US levels, our e-commerce 'readiness' is among the highest in the world. However, as a recent Goldman Sachs study has concluded, Australia is unlikely to have seen the productivity payoff from e-commerce in its 1990s performance, as the takeoff really only began at the end of the decade. (This is also likely to be the case in the United States.)

In sum, the evidence suggests that Australia, like the USA, has seen a pickup in ICT use which has contributed to its improved productivity performance in the 1990s. The productivity surge in Australia has been considerably stronger than in the USA. This is consistent with a catch-up component triggered by micro-economic reform. While reforms have brought significant efficiency gains unrelated to ICT, such as through better management and work practices, they have also created the incentives and capacity for enterprises to adopt and adapt to the new technologies in ways which appear to have yielded additional gains. The growing extent and sophistication of Australia's use of ICT suggests that, if as seems likely, there is a further wave of productivity gain to be had from e-commerce, Australia is potentially well placed to catch it.

Some policy issues in getting the most out of ICT

That does not mean that there is nothing for policy makers to do. On the contrary, ensuring that Australia can maximise the benefits from the 'ICT Revolution' demands a wide-ranging policy agenda to ensure that Australians have access to new technologies, as well as the incentive and capacity to use them most productively.

There are a host of policy issues to do with removing obstacles to the use of these new technologies posed by redundant laws and regulations, or conversely, preserving and re-casting regulations or social institutions that are affected by the new technologies.

Rules of commerce and other laws formed in a pre e-commerce environment have to be adapted. For example, laws have to be passed that recognise the validity of electronic transactions (as in the *Australian Electronic Transactions Act 1999*). There also needs to be protection of privacy, although this has to be weighted against compliance cost issues and the value that comes from sharing information (for example, in getting better medical or job outcomes). There are complex jurisdictional issues concerning where an illegal act is deemed to have taken place, that affect domestic social regulations and law (such as illegal gambling and

defamation). These jurisdictional problems also pose new challenges for consumer protection.

The benefits that stem from near zero cost transmission of information can strike at the property rights of those whose business is selling content —the Napster MP3 saga being a case in point.

Online technologies may also erode efficient broad tax bases. Just as the structure of national economies gravitated towards services in the latter part of the 20th century, it is expected that services will increasingly become online and global in the 21st century. But whereas many traditional services are readily taxable, it is hard to tax *virtual* services that can be provided from any global jurisdiction with the click of a mouse button.

Inevitably, the technologies raise a plethora of social issues. Just as for other sources of structural change, there is an imperative for a generous safety net for those displaced by change, but also one that assists people back into work through training support and job matching. Similarly, since the technologies are enabling for non-commercial purposes as much as commercial ones, the social issues raised by the 'digital divide' command serious attention.

Governments tend to be particularly active in funding or providing services in information-intensive parts of the economy — such as health, education, social welfare and other community services. Accordingly, effective use by government (or its sponsored agencies) of these emerging technologies may produce very sizeable benefits. For example, MIT in the United States will soon provide all lecture and course notes on its website free of charge — which lowers the cost of accessing key educational materials but also challenges the 13th century location-specific, bricks and mortar model on which most tertiary education is still provided.

A key condition for the dissemination and uptake of ICT is its accessibility and cost. The importance of having low-cost ICT is a good reason for continuing to acquire ICT equipment from the cheapest source. That will mean *importing* much of it, rather than attempting to foster high cost domestic production. (Software and content production appear more suited to Australia, being less dominated by scale effects and more open to exploiting market niches.)

The cost and availability of telecommunications services is obviously a key factor. The degree of competition in the telecommunications market has an important bearing on that. As the OECD observed:

> "Countries that moved early to liberalise telecommunications have much lower communications costs and wider diffusion of ICT than countries that were late to take action."

International benchmarking research conducted by the Productivity Commission, using prices at June 1999, revealed that Australia ranked about average by international standards. Notwithstanding significant price reductions in Australia, prices in the best performing countries were still 20-40 per cent lower – suggesting significant scope for further reductions. (The Commission has conducted more recent benchmarking research, but that was concerned with assessing price and service differentials between the city and bush across countries – in which respect Australia emerged as one of the better performers.)

Where telecommunications remains dominated by the traditional incumbent, the regulatory environment plays a key role in how effectively competitive pressures can be brought to bear to drive down costs – given natural monopoly and network externality effects.

The appropriateness and effectiveness of Australia's competition regulation of telecommunications has been the subject of a major public inquiry by the Productivity Commission over the past 14 months. Having benefited from extensive feedback and public discussion on our draft report, the final report has just been completed and presented to the Government.

That obviously means that I can't say much about this topic today. What I would like to emphasise, however, is the dual objectives of regulation in this area:

- On the one hand is the well-recognised need to ensure that the market power of Telstra (and in some circumstances other incumbents) cannot be abused – particularly through impeding appropriate access to downstream competitors and the investments and innovations that flow from that.
- On the other hand, however, the Commission has been mindful of the need to ensure that regulatory actions do not compromise incentives to invest in the essential infrastructure on which all else depends.

Getting that balance right is not straightforward, but we see it as critical to achieving efficient outcomes in the longer term that the regulatory framework provides clearer guidance.

The key in this area, as in others, is for regulation to be targeted only at problems that are of sufficient magnitude to warrant incurring the inevitable regulatory costs. Such intervention needs to be as light handed as possible and not divert firms from the search for more cost efficient and innovative ways of conducting their business.

A related issue of particular relevance to ensuring the most effective diffusion and innovative use of ICT is the need for regulatory frameworks not to be unduly prescriptive.

With advances in digital technology, telecommunications, broadcasting and the internet are converging rapidly. They are being redefined in terms of what they are, who provides services, and how they are produced and delivered – offering consumers and producers of services enormous opportunities.

It is not possible to predict and describe what direction the digital revolution will take. The directions and speed of convergence are unclear, but the inevitability of continuing change in the media and telecommunications industries is certain.

In such an environment, regulation must be flexible enough to deal with uncertainty and change. And it should not advantage some technologies or producers at the expense of others.

An important implication of convergence is that regulatory regimes that could once remain relatively distinct, now need to be coordinated. The convergence of telecommunications and broadcasting accentuates the pro-competitive emphasis of policy towards the former and the protective pall of regulation that shrouds the latter. Whether this can be sustained seems doubtful, but it was clear to the Commission in its recent inquiry into Broadcasting that attempting to do so could prove costly to the Australian community.

So policy makers need not fear any lack of important challenges! That said, in sketching this broad canvas of policy issues, I should not leave you with the impression that the problems are intrinsically new. To a large extent, the policy agenda is the same agenda that needs pursuing to get the most out of an 'old' economy, in terms of prudent reform of institutions and processes that stifle opportunity. A stable macroeconomy, openness to trade, and building human, social and intellectual capital will remain fundamental policy tenets, even if their particular manifestations differ. The new era also suggests an increasing importance for international negotiation and agreements — representing a natural evolution of the General Agreement on Trade in Services within the WTO, and other international agreements.

History has shown that enabling technologies have much to contribute to the living standards and well being of society. History also tells us, however, that the extent to which particular countries benefit depends critically on their institutional and policy *receptivity*. Australia has already made a substantial investment in enhancing its regulatory environment. And that has delivered significant returns in higher productivity and income growth – including through the more widespread and effective use of ICT. The economic opportunities now being presented by the internet and e-commerce make it imperative that we get on with the job.

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