

# AUSTRALIA'S INFORMATION LANDSCAPES

P. W. Newton

*New technologies and the infrastructure and industries that develop around them have continuously shaped and re-shaped physical and cultural landscapes throughout history. While the antecedents of the information and communications revolution can be traced back beyond the twentieth century, the major burst of telematic products and services and their supporting infrastructures has occurred over the past quarter century. Furthermore, this development is accelerating. The manner in which information and communications technologies are re-shaping patterns of urban settlement is as yet not clear, however. The present paper identifies some emerging trends in the Australian context.*

Keywords: Information and communication technology, information economy, infrastructure, telematic services, information industries, urban hierarchy.

## INTRODUCTION

Australia's natural landscapes are recognisable by most of its inhabitants. Reference to places such as Ayers Rock, Kakadu, the Great Barrier Reef, Sydney Harbour, the Nullabor Plain, the Pilbara and the Daintree are normally sufficient to evoke powerful images and a sense of identification. Australia's cultural landscapes also tend to be well recognised. Comprising as they do the artefacts of a relatively short period of European settlement, the high rise commercial cores of the capital cities, an expansive suburbia, the ribbon shopping strips, the regional malls, country towns and the more remote mining centres — all represent features which we can readily identify with.

By way of contrast, Australia's information landscapes are now, for the most part, *terra incognita* — unknown territory. What once were the early, visually obvious and for the most part understandable infrastructures of a technologically primitive information economy — the plain old telegraph and telephone systems — have given way to satellites, microwave radio and subterranean optical fibre, linking a virtual network of people and buildings located across the street and around the globe. Telematic products and services such as EDI, ATM, EFT/POS, videotext, modem, telepoint, CMTS, packet switching, ISDN, LANs, MANs and WANs, to name but a few, evoke minimal recognition (much less understanding) from the population as a whole yet are fundamental to the functioning of contemporary society and advanced information economies.

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The influence that the new products, services and infrastructures of the information age are having on redefining patterns of work, residence and leisure are little understood. Even less is known of the manner in which new information and communications technologies (ICTs) are functionally (and ultimately physically) reshaping the national pattern of settlement. Are historically established urban forms and hierarchies being perpetuated and perhaps accentuated? Or are the new technologies and their embodiment in a range of human-organisational activities providing opportunities for business and residence alike to establish new patterns of spatial association? Are ICTs a force for centralisation or decentralisation of activity? Or are they permitting both? The verdict is not yet in on such questions, but the present paper attempts to outline evidence assembled to date. In so doing it begins by establishing the significance of the information sector within the context of the national economy.

## **THE INFORMATION ECONOMY**

There is now little debate concerning the existence of the information sector in national economies, although the size and importance of the sector will vary between countries according to their level of development. This sector has continued to exhibit growth over a long period, as information has increasingly formed an important part of the economy, but most notably since the 1940s.<sup>1</sup> For example, in Australia the size of the labour force involved in what could be classed as information-related activity is now approaching 40 per cent (see Table 1); other studies have placed it slightly higher.<sup>2</sup> By the turn of the century the information sector will be the major contributor to GDP as well as employment.

The increased importance of information to urban and regional economies is evident from the continued growth of the information sector in the economic base of all major metropolitan areas in Australia. Their transformation has been one from centres of production and distribution of material goods to centres of information exchange, service production and consumption as well as manufacturing. The evolution to a service and information oriented society should continue to stimulate demands for telecommunications infrastructure and services given that information is a key factor in production across all sectors. Indeed, Goddard argues that it is more appropriate to our understanding of the evolution of industrial activity to recognise that manufacturing and service sectors are becoming increasingly dependent on effective information management.<sup>3</sup> The information sector grows as it services the information production, processing and distribution needs of other sectors as well as generating growth in its own right via commercialisation of information and communication technologies and their infrastructures. As the Office of Technology Assessment study also notes: " ... as productive processes become increasingly complex in

advanced industrial societies, the largest reserve of economic opportunities will be in organising and coordinating productive activity through the process of information handling".<sup>4</sup>

**TABLE 1**  
**EMPLOYMENT TRENDS BY MAJOR INDUSTRY SECTOR**  
**1954-1986: MAJOR URBAN CENTRES**

Urban Centre	Industry Sector (% Persons Employed)						Employment to Population Ratio (1985)
	Manufacturing		Services		Information		
	1954	1986	1954	1986	1954	1986	
Sydney	37	17	41	40	20	39	.43
Melbourne	40	21	39	37	19	37	.44
Brisbane	28	14	46	42	23	39	.42
Adelaide	36	17	43	39	18	39	.42
Perth	25	13	50	42	22	39	.43
Newcastle	41	19	39	39	12	32	.37
Canberra	6	4	34	30	55	63	.50
Wollongong	45	27	34	35	9	30	.38
Gold Coast	13	9	59	52	17	32	.35
Hobart	26	12	46	40	25	44	.41
Geelong	46	27	39	36	12	31	.39
Townsville	23	9	54	44	20	43	.42
Darwin	6	5	48	39	40	51	.47
Toowoomba	25	13	32	43	38	38	.38
Launceston	30	17	49	43	18	34	.39
Ballarat	37	17	41	39	18	39	.36
Cairns	21	9	57	50	16	34	.38
Rockhampton	30	11	50	51	16	33	.40
Australia	28	15	39	39	17	36	.41

ASIC Classification: Information Sector (Communications, Finance, Property, Business, etc., Public Administration, Community Services)

Source of Data: P. W. Newton, 'The new urban infrastructure: telecommunications and the urban economy', *Urban Futures*, Special Issue No. 5, February, 1992, pp. 54-75.

With few exceptions, the trend appears to be that urban centres with a higher than (national) average involvement in the information economy also enjoy higher than average economic health, as measured by the employment to population ratio, recognised as one of the best available measures of economic wellbeing of a metropolitan area.<sup>5</sup> That this

should be so is due in no small part to the more flexible economic base that has characterised those centres which have shifted furthest from a situation of dependence on a relatively specialised industrial base to one of diversity among an increasing concentration of information intensive companies, companies which exhibit greater capacity for moving in new directions as opportunities for growth or change emerge.

### *Infrastructure availability and utilisation*

The ability of both the private and public sector to instal new transport and communications technologies and use them in innovative ways is viewed by many academics and bureaucrats alike as a vehicle which enhances the competitive advantage of regions, attracts development and promotes a centre's standing within the national settlement hierarchy.

### *Telecommunications*

Recent studies which have sought to examine the relationship between the economic growth performance of urban regions and their telecommunications infrastructure have engendered opposing positions. On the one hand there are those who argue that with the growth of IT-dependent business functions, communications will become a key determinant of whether cities and regions attract or lose business.<sup>6</sup> On the other hand there is the thesis which, in its most basic form, suggests that telecommunications is a necessary but not sufficient condition for regional development; that communications issues tend to rate relatively low in surveys of industrial relocation decision-making; that communications represents a relatively small (albeit rising) proportion of the operating budget of organisations; and that communications is a relatively ubiquitous infrastructure, access to which is generally not a problem for business.<sup>7</sup> In other words, little significant difference exists between competing cities with regard to telecommunications infrastructure certainly — none that could not be relatively quickly overcome, should the need arise. Similar arguments have been advanced by Bar who argues that telecommunications technologies are useful indices of a region's economic activity, but are not magnets for economic development:

It is also difficult to envision cases where the Telecom network would determine a firm's [choice] between two neighboring cities because telecom networks act quite differently from railroads: the telecom network reaches everywhere, and can easily be extended much more easily and economically than a railroad could. Furthermore, at least within the United States, if a company is large enough substantially to affect economic activity in a region or locale, it usually can get virtually all of the communications facilities and services it needs for its business regardless of where it chooses

to locate. While it was hard for firms to build their own railroad, they have found it very easy to install satellite dishes or microwave equipment when the network in place did not meet their needs.<sup>8</sup>

Is such a thesis valid? Are there no spatial implications of telecommunications technology and telecommunications infrastructure, save for the potential that telecommunications has to collapse distance completely? To explore the nexus between telecommunications, geography and economic development it is useful to consider how telecommunications confers productivity benefits to organisations and to regions. At least two of the key dimensions are outlined in Figure 1 below: on one axis we have the necessary conditions of availability; on the other the sufficient condition, utilisation. In the sections which follow, we briefly explore for a range of telematic network services, patterns of telecommunications availability and utilisation from a spatial perspective.

● **PSTN (public switched telephone network):** The PSTN hosts, in addition to voice services, a variety of other value added services such as 008 and fax as well as automated subscriber trunk dialling (STD) and international direct dial (IDD) services. Their availability is virtually Australia-wide.

Introduced in 1979, 008 services permit long distance telephone calls at local rates and commonly on a 24-hour basis, and have the potential for extending the market catchment for a particular private or public sector enterprise to national boundaries and beyond. The industry and settlement implications are difficult to anticipate. In theory, 008 services provide opportunities for the location of business establishments in either urban or non-urban environments. In practice, they appear to be centralising business in the most populous states.<sup>9</sup>

The take-up of G3 facsimile transmission on the PSTN within Australia has been dramatic and the statistics on penetration by urban centre reveal a clear division between the five largest cities where telematic services (as measured by fax) are concentrating at levels appreciably higher than city size alone would suggest.<sup>10</sup> By way of contrast, Newcastle and Wollongong constitute Australia's major centres of heavy industry (iron and steel); centres which appear, on this evidence, to be in the process of being by-passed as foci for the more information-intensive type of activities common to most of the capital cities.

● **STD:** Penetration of STD is now universal within Australia. Until that point, however, the more remote country regions were disadvantaged by lack of 24-hour automatic switching services and the access that provides to the rest of the nation and the world. Furthermore, virtually all non-metropolitan centres have a higher proportion of long distance versus local calls, reflecting the strong metropolitan orientation of telephone traffic within all Australian States.<sup>11</sup> Such ratios also point

**FIGURE 1**  
**DIMENSIONS OF TELECOMMUNICATIONS PRODUCTIVITY**

		Utilisation	
		Applications & Performance	Price
Availability	Technological Capacity		
	Geographic Coverage		

to an added disadvantage faced by country centres in attracting information-intensive industry — the impost that STD rates impose during business hours. Extension, or elimination of STD zones may encourage companies to move out of cities, but would deprive telecommunications organisations of revenue.

● **CMTS (Cellular mobile telephone service):** CMTS is now operating in all State capital cities and major regional centres, covering over 75 per cent of the Australian population. Highway coverage is also being expanded, with almost continuous coverage currently available between Melbourne and Albury, Canberra and Sydney and Sydney to Brisbane along the coast road. From the limited data available in this highly competitive telecommunications area it would appear that take up has been strongest initially in the states of Victoria and NSW.<sup>12</sup>

● **ISDN (Integrated services digital network):** Computer networking began commercially in Australia in 1969 with the introduction by Telecom of a modem service that would operate on the PSTN to provide digital-analog conversion necessary for computer-to-computer communication. The technological limitations of this service have been progressively overcome as other networks were introduced during the 1980s, with the introduction of the most recent service, ISDN in 1989. Lazak comments from a German perspective that as ISDN is now available, advanced users of network systems are trying to install it as soon as possible, yet it is estimated that it will take from thirty to forty years to switch over from old to new networks throughout that particular country<sup>13</sup> The spatial implications for the transition period are a 'landscape of ISDN islands, both nationally and internationally'. At

the international level, Lazak envisages advanced networks with access and distribution nodes, termed teleports, providing user access to the most advanced communication systems worldwide, irrespective of the status of networks throughout particular countries.<sup>14</sup> At national levels, Zamanillo describes what is typical of phased introduction of ISDN over the PSTN: trunks first, then exchanges, then subscriber lines — initially in areas considered most likely to exhibit high levels of demand.<sup>15</sup>

Against such forecasts of significant time lags before certain regions are connected to the latest telematic networks, what has the experience been to date with ISDN in Australia? Two years after its introduction, 36 per cent of exchanges in NSW and 29 per cent in Victoria had ISDN capability.<sup>16</sup> Clearly, at national/regional levels there are 'ISDN islands'. In Victoria by mid-1991, 83 per cent of exchanges with ISDN capability were in Melbourne. Within the major cities there has also been rapid penetration: in Melbourne, over 85 per cent of business and commercial centres have ISDN access; in Sydney the figure is in excess of 90 per cent. In terms of utilisation of ISDN, NSW and Victoria again exhibit levels slightly above that which their share of business establishments would suggest.<sup>17</sup>

● **IDD (international direct dial) and globalisation:** Many large, multi-functional corporations were operating on an international basis prior to the twentieth century, but their growth and proliferation have been most pronounced since the Second World War. Reasons for this trend have been examined elsewhere and need not concern us here, save for the integrating role that advanced information and communications technologies have played in the process.<sup>18</sup> To our way of thinking, globalisation from a telecommunications perspective requires, as a minimum, 24 hour point-to-point real time connectivity for voice and text services between communities located anywhere in the world. This has increasingly become a reality for urban communities in advanced industrial societies over the past decade or so. Real time transmission of large data and image files must await the introduction of broadband services in the mid-1990s, however. This will then open up the prospects for the internationalisation of an even wider array of key business activities, including: operations, service, technology development, design, human resource management, procurement, marketing, sales, dispatch, etc. Under these circumstances, the firms which seek comparative advantage by allocating their activities among a number of countries to gain the optimum advantage, will increasingly be able to integrate their distributed information systems and undertake operations as if in a single locality.<sup>19</sup>

From the time of its introduction in 1976, international direct dial has sustained average rates of growth of between 20-30 per cent per year, as local exchanges have been progressively connected to the service (penetration now stands at greater than 97 per cent) and as overseas

countries become interconnected (13 in 1976, over 200 in 1991). Availability of automatic international direct dial facility is not, however, reflected in utilisation patterns — as we have found with other telematic services.

Table 2 reveals a number of important contrasts in the pattern of international telecommunications traffic which is outgoing from each of Australia's major urban centres. It is clear that Sydney is attracting all the hallmarks of a world city, with an almost 50 per cent share of business traffic among the top 20 cities. Melbourne and Gold Coast are the only other cities which have a share equal to or above that which their location in the urban hierarchy would suggest.

**TABLE 2**  
**SHARE OF INTERNATIONAL TELECOMMUNICATIONS ACTIVITY:**  
**AUSTRALIA'S MAJOR URBAN CENTRES**

Urban Centre	Population Share (1991)	Outgoing Business IDD Share (1992)
Sydney	28.3	46.3
Melbourne	25.2	25.9
Brisbane	10.4	7.0
Perth	9.3	8.4
Adelaide	8.7	4.1
Canberra	2.5	1.9
Newcastle	2.4	0.5
Gold Coast	2.1	2.2
Wollongong	1.9	0.3
Central Coast (NSW)	1.8	0.3
Hobart	1.2	0.4
Geelong	1.2	0.5
Townsville-Thuringowa	0.9	0.3
Toowoomba	0.7	0.1
Darwin	0.6	0.5
Launceston	0.6	0.1
Ballarat	0.6	0.1
Cairns	0.6	1.0
Bendigo	0.5	0.1
Rockhampton	0.5	0.1
<b>TOTAL</b>	<b>100.0</b>	<b>100.0</b>

Source: OTC, ABS



*Air transportation*

For the role it plays in the movement of business personnel for a range of decision-making and knowledge-exchange activities requiring face-to-face contact; for tourism and for the shipment of high value to weight components for JIT manufacturing, air transport continues to expand its role in advanced industrial economies.

Australia's cities, however, vary widely in their ability to add to their airport infrastructure and to subsequently provide greater opportunities to local business to establish network-based industries that do not rely to any degree on physical propinquity.<sup>20</sup> As Batten remarks:

Contiguity of places and even of regions is becoming less significant. The old tree-like transportation network structure, with its sparse, scale-oriented links, is gradually being supplanted by a multi-layered grid of road, air and telecommunications networks possessing completely different characteristics...Together these new networks possess tremendous potentials for synergy...at practically any location within the...developed world.<sup>21</sup>

**TABLE 3**  
**INTERNATIONAL AND DOMESTIC AIR PASSENGER TRAFFIC**  
**TO MAJOR URBAN CENTRES, 1982 AND 1990**

Urban Centre	Inbound Passengers					
	Number 1982	International		Number 1982	Domestic	
		('000) 1990	% Change		('000) 1990	% Change
Sydney	1226	2112	72.3	3010	3838	27.5
Melbourne	506	878	73.6	2452	3100	26.4
Brisbane	223	562	155.7	1456	1885	29.4
Adelaide	5	93	1750.2	931	937	11.7
Perth	225	439	95.2	547	740	35.3
Newcastle	--	--	--	111	78	-29.9
Canberra	--	--	--	416	499	19.7
Wollongong	--	--	--	--	--	--
Gold Coast	--	--	--	295	410	39.1
Hobart	7	9	38.1	233	268	15.2
Geelong	--	--	--	--	--	--
Townsville	14	9	-34.5	231	189	-18.0
Darwin	18	46	154.4	152	193	27.0
Toowoomba	--	--	--	--	--	--
Launceston	--	--	--	197	189	-4.1
Ballarat	--	--	--	--	--	--
Cairns	8	145	1703.0	221	399	80.7
R'hampton	--	--	--	103	85	-17.4
Bendigo	--	--	--	--	--	--
Total	2232	4293	92.3	10355	12810	23.7

Source: Department of Transport and Communications

Sydney is Australia's key gateway to international passengers with half of all in-bound movement in 1990 and with Melbourne having a 20 per cent share (Table 3). Both cities have lost a small percentage of their share as other state capitals have attempted to secure a greater proportion of international flights as congestion and curfews currently inhibit Sydney's capacity (prior to its securing additional capacity via a third runway and second airport) and as the federal government limits the opportunities of cities such as Melbourne to directly negotiate agreements with international airlines to headquarter their operations out of cities other than Sydney.

The rate of growth of domestic air travel has been significantly less than that for international, and while Sydney retains a higher level of traffic than Melbourne (30 versus 24 per cent) neither have lost overall share during the past decade. The gains by Perth, Gold Coast, Brisbane and Cairns have been mostly at the expense of the lower order cities and mirror trends in inter-regional population redistribution identified in Flood *et al.* and Wulff *et al.* in relation to sun-belt migration.<sup>22</sup>

#### **TOWARDS A CONCEPTUALISATION OF TELECOMMUNICATIONS AND SPATIAL DEVELOPMENT**

Most studies that attempt to assess the manner in which telecommunications affects the geography of economic activity end up with conclusions that are essentially equivocal.<sup>23</sup> They are that the computer-telecommunications environment of the 1990s (PCs, workstations, intelligent terminals, distributed database technology — LANs, MANs and WANs) permit organisations to choose centralisation, or decentralisation, for a wide range of business functions. These could include management decision-making, inventory management, operations, service, technology development, human resource management, infrastructure management, procurement, marketing and sales.

Keen argues, on the basis of an assessment of organisational pros and cons, that telecommunications allows decentralisation with centralisation.<sup>24</sup> While computer-communication technology has now reached a sufficient state of maturity to permit integration of geographically distributed information systems without centralisation,<sup>25</sup> there appears to be a common tendency among the larger organisations for telecommunications to "...increase central control through ownership of data and the ability to monitor decentralised units".<sup>26</sup>

Indeed, the information and communication sector has grown primarily in response to the increasing complexity of the economic system and the increasing demands this places on information handling — given that each economic transaction is necessarily associated with a flow of information.<sup>27</sup> As the flow of economic transactions intensified and extended beyond local economies to national economies and ultimately to a world economic system, it precipitated what Beniger

termed a crisis of *control*, which demanded new means of communication.<sup>28</sup> The communications infrastructure we have today is an accumulation of networks developed over many decades, designed to direct and mediate, in the most efficient possible manner, the flow of information, people and goods between areas and sectors of the economy.

Telecommunications clearly is making its greatest impact with regard to what Lion and Van Der Mark term structural decentralisation — the ability of businesses to separate their management and production functions and facilities — although geographic decentralisation is also occurring.<sup>29</sup> Noyelle and Peace point to an increasingly wide range of jobs, including higher level jobs, decentralising (for technological, labour and capital reasons).<sup>30</sup> Yet, these forces appear insufficient to generate relocation outside cities in the United States for a variety of market, technology, infrastructure and organisational reasons.

We now proceed to explore some of these issues in the context of contemporary trends in the locational behaviour of business within Australia.

### *Corporate headquarters*

Large organisations view telecommunications as a strategic business tool. They have the capacity to generate innovative applications for new telecommunications technology. They are sufficiently large to absorb the cost of new technology. They typically have the skill base to fully exploit new opportunities provided by the technology (indeed many have established their own private networks, bypassing the public network). They typically locate their key headquarters operations in environments rich in infrastructure and human capital. The settlement implications are clear: Sydney and Melbourne dominate the corporate hierarchy to an even greater extent than they do the urban hierarchy (see Table 4), bringing with them the need for the sophisticated systems of control which are embodied in modern telecommunications. It is therefore not unexpected that, of Australia's top 100 communication's companies, over 90 per cent are also headquartered either in Sydney or Melbourne (Australian Communications Networks, December, 1988). Key producer firms (e.g. McKinsey, Arthur Anderson, Ernst and Young, etc) also tend to locate in proximity to their corporate clients.

The current pattern of demand for higher speed networks (see Table 5) is also centred most strongly in Sydney and Melbourne, and the central business districts of the other states. The higher concentrations found outside the central cores in Sydney and Melbourne reflect the existence of suburban concentrations of information-intensive industry not evident

to the same degree in the other state capitals (discussed in a subsequent section). The CBD concentrations in all states reflect the telecommunications intensity demanded of head office control functions associated with the locations of Australia's top corporate headquarters and government departments.

**TABLE 4**  
**LOCATION OF AUSTRALIA'S LARGEST CORPORATIONS, 1982-1990**

Urban Centre	Distribution of Headquarters (per cent)			
	Top 500 Companies		Top 100 Companies	
	1982	1990	1982	1990
Sydney	46.0	45.6	52.0	54.0
Melbourne	31.8	28.6	40.0	33.0
Brisbane	5.4	6.8	4.0	3.0
Adelaide	6.0	6.4	2.0	4.0
Perth	5.0	6.6	1.0	4.0
Newcastle	0.2	0.2		
Canberra	0.6	0.6	1.0	
Wollongong		0.2		
Gold Coast		0.4		
Hobart	0.6	0.6		
Geelong				
Townsville	0.2			
Darwin		0.4		
Toowoomba		0.2		
Launceston	0.2	0.2		
Ballarat				
Cairns				
Rockhampton				
Bendigo	0.2			
Other Urban Centres	1.0	1.6		
Overseas		0.6		2.0
Location not identified	2.8	1.0		
Total Australia	100.0	100.0	100.0	100.0

Source: Australian Business; Riddell's *The Business Who's Who of Australia*.

**TABLE 5**  
**SPATIAL CONCENTRATION OF HIGH SPEED DATA LINES\*, 1990**

Locality	Number of Services/ Lines	Per cent of of State Total	High Speed Lines (% of total)	Share of Business Establishments %
<b>NSW</b>			46.1	35.5
Sydney CBD	1819	46		
Remainder Sydney	1989	50		
Remainder NSW	169	4		
Total	3977			
<b>ACT</b>	531			
<b>Victoria</b>			33.5	25.8
Melbourne CBD	1943	59		
Remainder Melbourne	1288	39		
Remainder Victoria	48	2		
Total	3279			
<b>Queensland</b>			6.3	18.2
Brisbane CBD	455	74		
Remainder Brisbane	125	20		
Remainder Queensland	37	6		
Total	617			
<b>WA</b>			7.0	8.8
Perth CBD	548	80		
Remainder Perth	91	13		
Remainder WA	44	7		
Total	683			
<b>SA</b>			6.8	8.9
Adelaide CBD	525	78		
Remainder Adelaide	130	19		
Remainder SA	15	3		
Total	670			
<b>Tasmania</b>			0.3	2.8
Hobart CBD	17	50		
Remainder Hobart	2	6		
Remainder Tasmania	15	44		
Total	34			
Australia Total	9791		100.0	100.0

\* Lines operating at 48 Kbps and 2 Mbps

Source: Telecom Australia

*Information-intensive industries*

In attempting to gain a broader perspective on the distribution of information-intensive industry, we embrace the conceptual frameworks of earlier workers such as Porat and Hepworth who conceive of key groupings related to information production, information processing and information distribution; while abandoning their route to measurement.<sup>31</sup> Use of census-based industrial or occupational taxonomies which reflect now out-dated industrial groupings or divisions of labour are replaced by the currently superior detailed business group divisions of the Telecom Yellow Pages Business Directory.

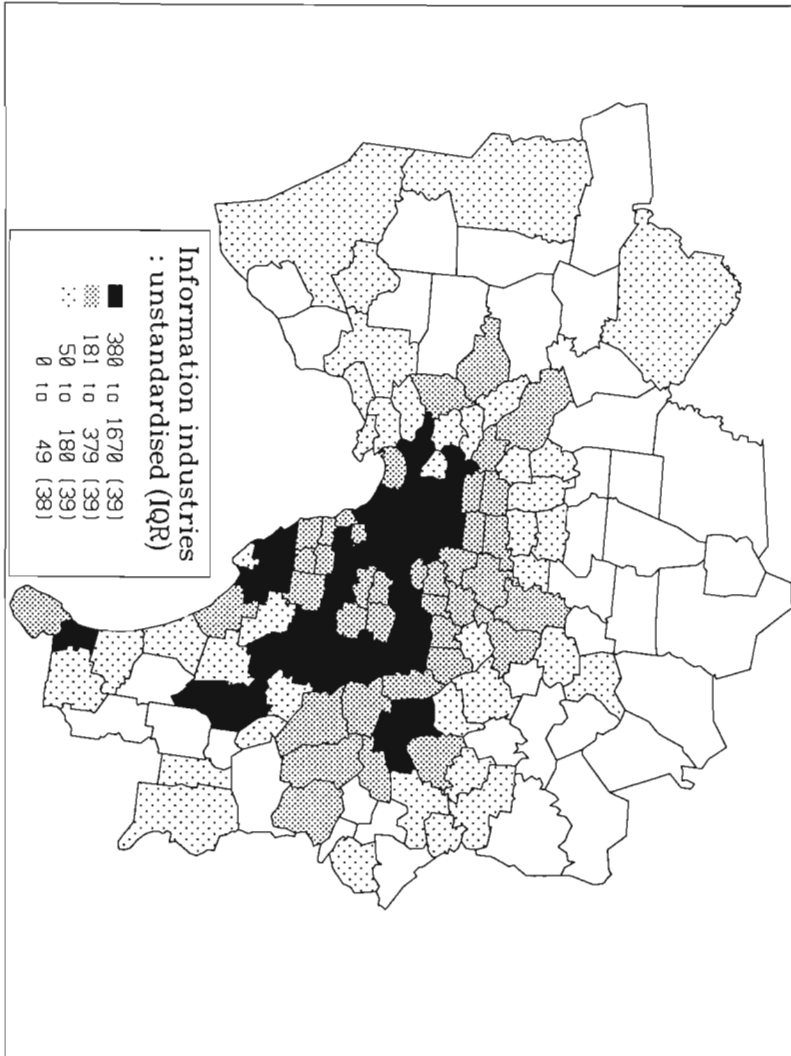
Maps depicting the locational patterns of primary information industries (a combination of information production, processing and distribution industries) in Australia's two largest cities, Sydney and Melbourne, are found in Figures 2 through 5. (These maps are based on data extracted from Telecom's Yellow Pages CD-ROM Directory according to the taxonomy listed in Table 6 and aggregated to districts according to the telephone prefix in the listing).

**TABLE 6****TAXONOMY OF PRIMARY INFORMATION SECTOR INDUSTRIES**

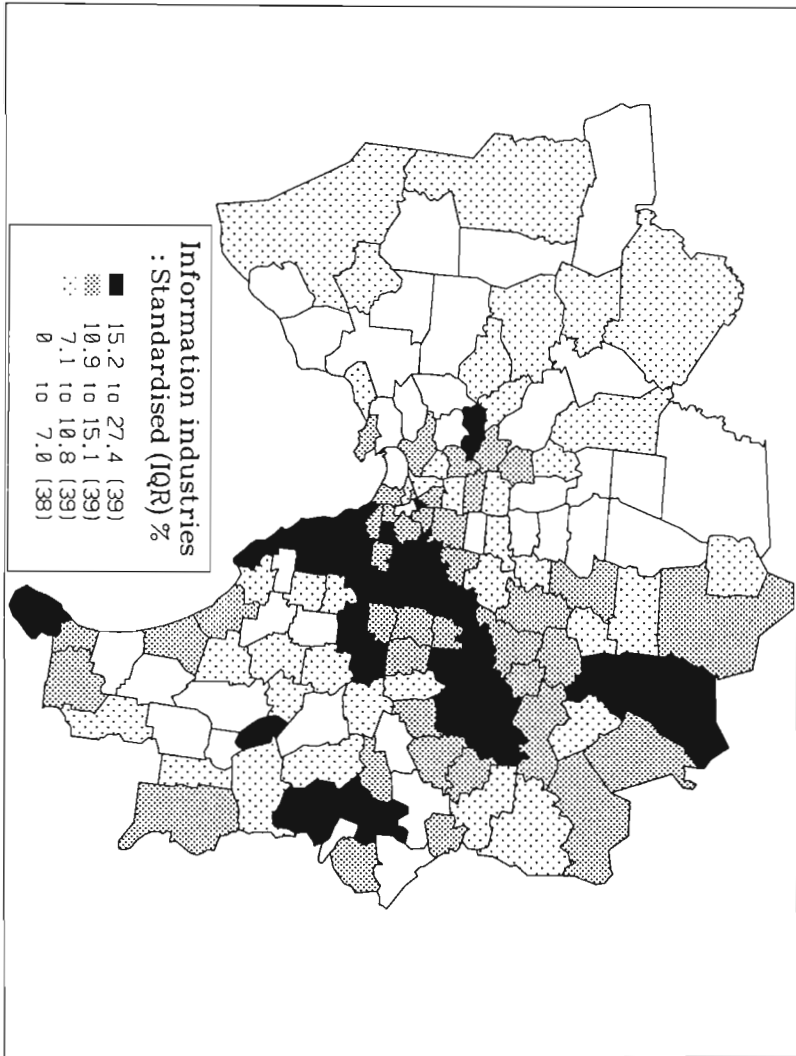
Sector of Information Industry	Constituent Industry Groups
Information Production	Knowledge production (e.g., R & D), consultant services (e.g., engineering, economic, etc.), market search, information collection and coordination.
Information Processing	Information transformation and storage (e.g., data processing), brokerage industries, advertising and marketing, non-market coordination industries, insurance and finance industries, public information and regulatory services.
Information Distribution	Education (primary, secondary, tertiary), communication (all media).

They reveal that there is no spatial ubiquity with primary information industries at intrametropolitan level; they reveal distinct clustering or agglomeration tendencies which result from the benefits which they gain from locating near complementary primary information industries (producers, processors, distributors) as well as client industries which 'sub-contract' their services. The CBD exhibits absolute concentrations of primary information industries several times above the level found in the middle-ranking centres in the middle-ring suburbs — although when the data is standardised according to the total number of business establishments in each area, the inner city loses its dominance (especially in Melbourne) to be replaced by suburbs where information industries constitute a high percentage of the overall stock of business organi-

**FIGURE 2**  
**MELBOURNE'S PRIMARY INFORMATION INDUSTRIES**  
**— UNSTANDARDISED**

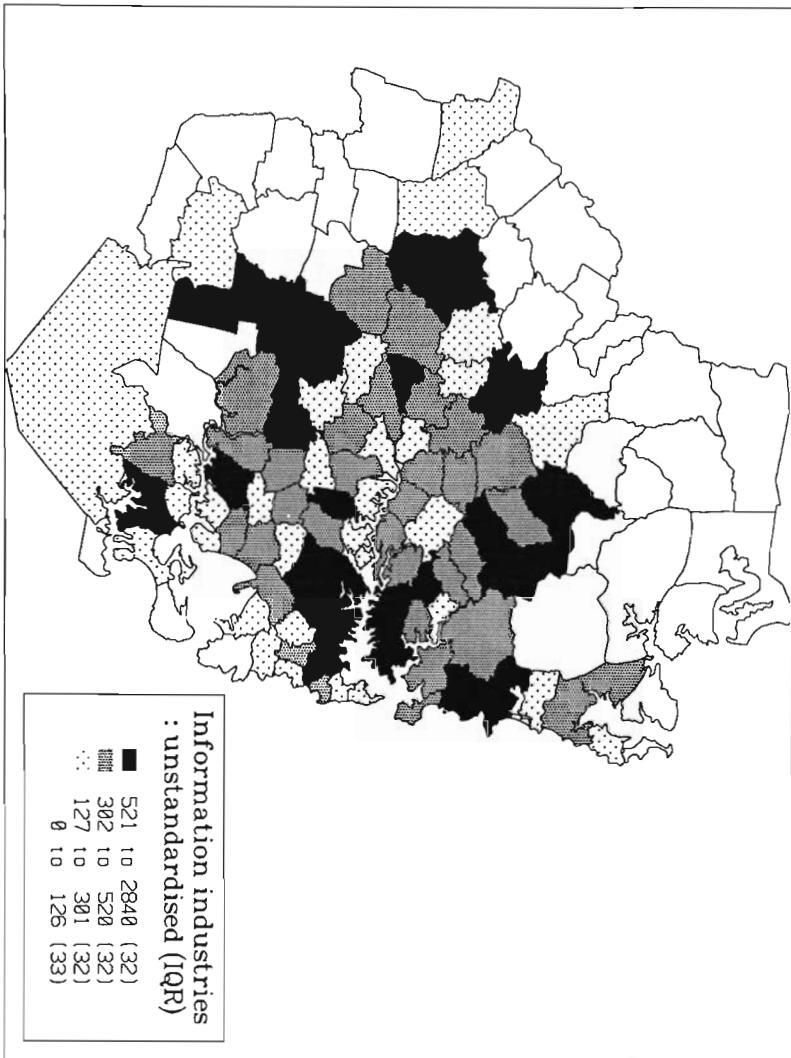


**FIGURE 3**  
**MELBOURNE'S PRIMARY INFORMATION INDUSTRIES**  
**— STANDARDISED**

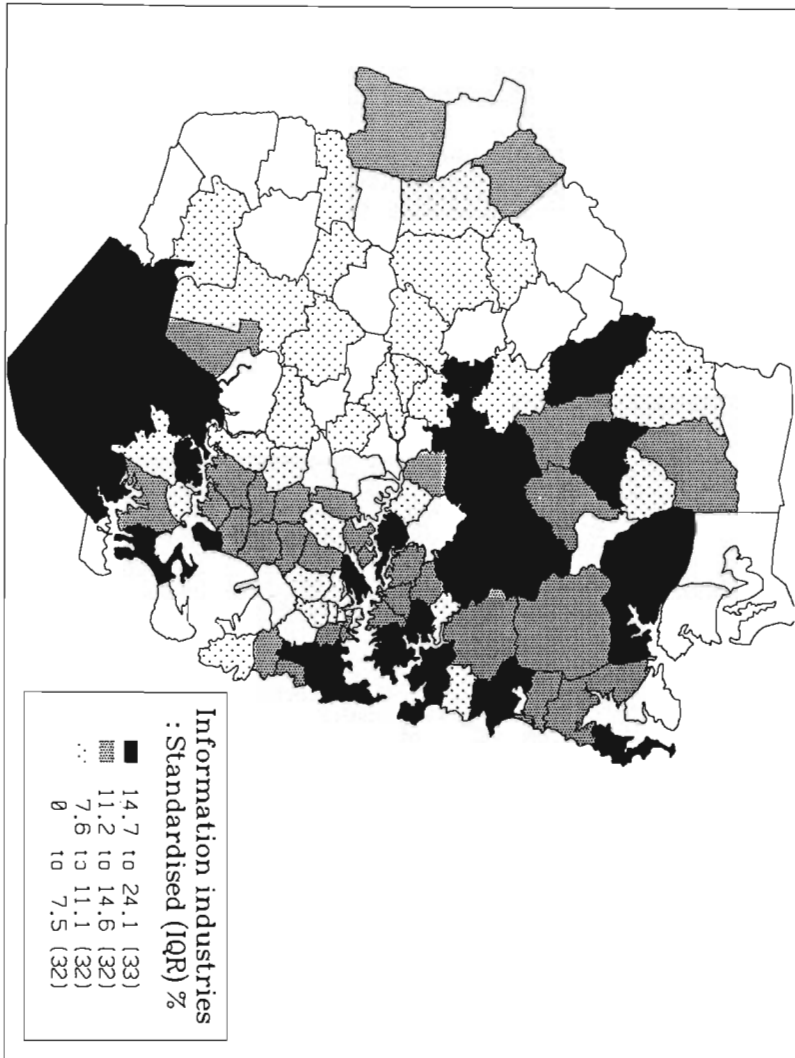




**FIGURE 4**  
**SYDNEY'S PRIMARY INFORMATION INDUSTRIES**  
**— UNSTANDARDISED**



**FIGURE 5**  
**SYDNEY'S PRIMARY INFORMATION INDUSTRIES**  
**— STANDARDISED**



sations. The outer suburbs generate relatively few primary information industries at all. The attraction of the CBD to such industries is at least two-fold: proximity to the offices of major business corporations and those of both federal and state government and the necessary infrastructure support, including telecommunications located at the core. The attraction of particular inner and middle-ring suburbs to information industries relates primarily to the labour market and housing market characteristics of those areas.

With Melbourne's primary information economy we essentially have a tale of two cities. Information workers and information industries occupy similar geographic spaces within the metropolitan area.<sup>1</sup> Being environmentally benign, information industries do not warrant or attract the exclusionary zoning meted out to light industry. Furthermore, perhaps more than any other sector of industry, the key resource base of the information-intensive sector is skilled labour and knowledge-workers. In such cases, industry tends to follow workers — subject to suitable real estate — to the professional-managerial heartland of the major cities, maintaining and in some cases accentuating the patterns of social class segregation established in earlier periods.

### *Network Firms*

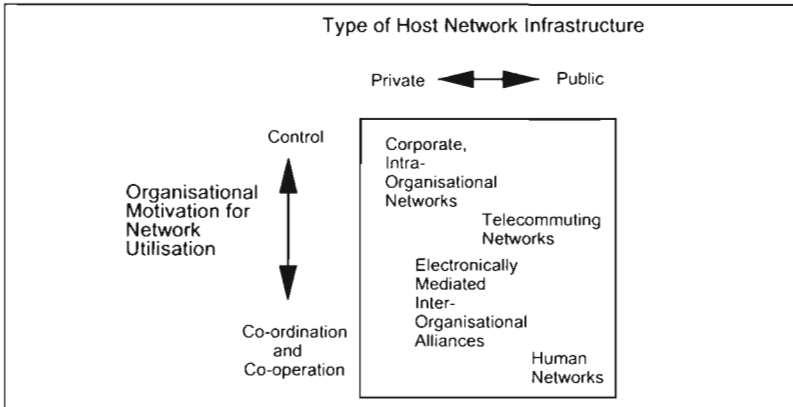
The previous analyses paint an aggregate picture of the geography of the information economy in Australia's largest cities, providing several insights into the revealed locational preferences of information-intensive firms, but lacking sufficient detail to provide the basis for examining such hypotheses as the tendency of organisations to decentralise with centralisation. We conclude by documenting case studies of large, multi-locational firms — a class of organisation which has been pioneering in their use of computer-based communication networks.<sup>2</sup> This class of organisation must be seen in a wider economic and communications context, however (see Figure 6).

Information and communications networks are a ubiquitous infrastructure in advanced societies, supporting a range of interactions from individual through to corporate levels.

Intra-organisational networks are used primarily to control the flow of goods, ideas and capital within the organisation, incorporating capability for feedback, command, strategy development and surveillance. As the size and complexity of organisations have increased over past decades (viz. through mergers and internationalisation), the need for better control technologies has also grown. The technological underpinnings for such developments have been networked computing — distributed database technology, personal computing systems linked to LANs and WANs and low cost transmission.

Inter-organisational alliances are also intensifying as the larger organisations are experiencing difficulty in sustaining growth and profits in the face of global competition and the rate of change in business

**FIGURE 6**  
**ORGANISATIONAL LOGIC OF COMMUNICATION NETWORKS**



and product cycles. Many large firms are being broken into smaller enterprises or businesses, co-ordinated in part by electronic networks. Decisions are being made whether to manufacture components internally or purchase them from a contractor. Overall there seems to be a trend away from vertical integration towards the proliferation of smaller, more flexible firms which are capable of responding more quickly to demand impulses. In many enterprises these changes are precipitating shifts in organisation and network philosophies from those centered on control to those based on co-operation and co-ordination.

**Coles Myer Limited**

The geography of Australia's major retailing corporation reveals a national head office which relocated in the late 1980s from the CBD to the fringe of the inner ring of suburbs in Melbourne; most of the state and regional control centres are also in the middle-ring suburbs — all within a labour market area capable of supplying the full complement of personnel for this strata of corporate activity (see Figure 7 which overlays the distribution of information workers on the nodes of Coles Myer establishments), and readily accessible to those housing submarkets preferred by professional and managerial employees. Those headquarter functions that remain in the CBD are relatively limited by comparison and relate most directly to department store operations — operations historically tied to downtown and still usefully performed there. Most of the firms which offer key services to the corporate retailer to a degree which warrants installation of dedicated networks (e.g., advertising, customs, specialist ICT, banking) also agglomerate most strongly in the inner city.

### **National Australia Bank (NAB)**

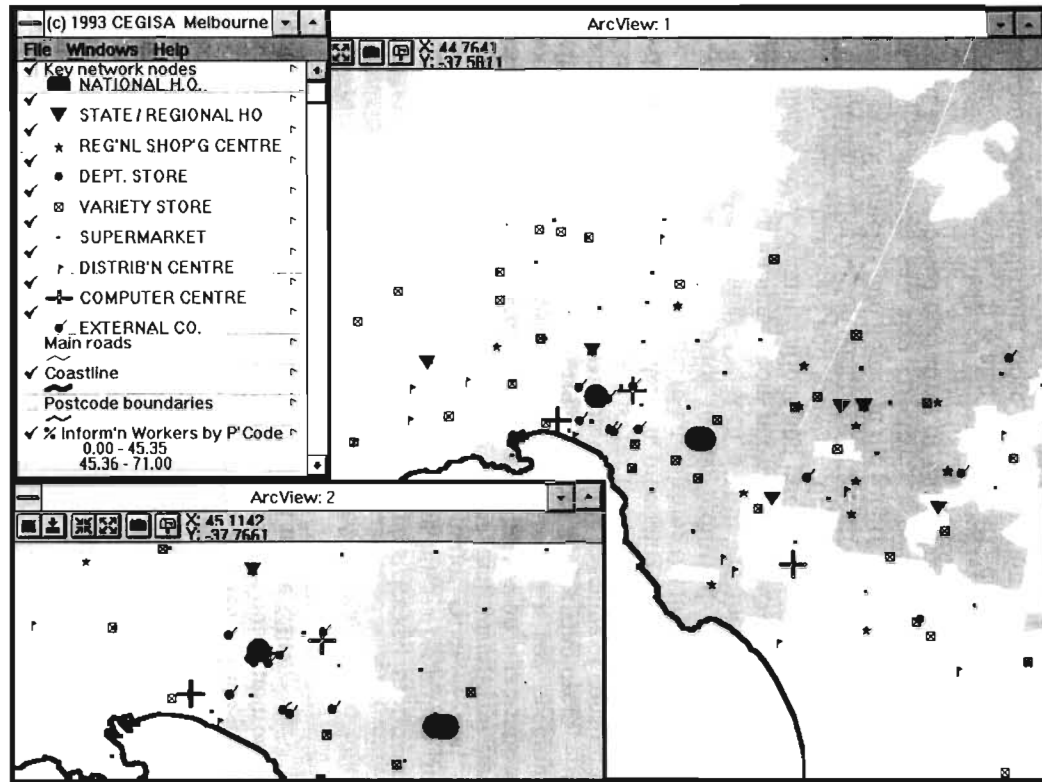
Banking represents an organisational contrast to that of retailing in relation to location of business establishments and use of networks. Its network of branches provides a spatial coverage which favours those areas of higher disposable income to the east and south of the CBD. It is in this sector also where most of the bank's regional offices are located, each serving a small constellation of branches (Figure 8). The creation of this new level in the hierarchy has permitted a measure of labour downsizing and deskilling at branch level with a commensurate increase in telecommunications traffic associated with the need to query information or tap expertise which has been centralised at regional and head office levels. As with many large corporations, there are dual data processing centres, providing redundancy for emergency situations where backup is required. Other 'generic' corporate features include a main data processing centre located in Melbourne's middle-outer suburbs and a collection of head office functions located in the CBD.

#### *Telework*

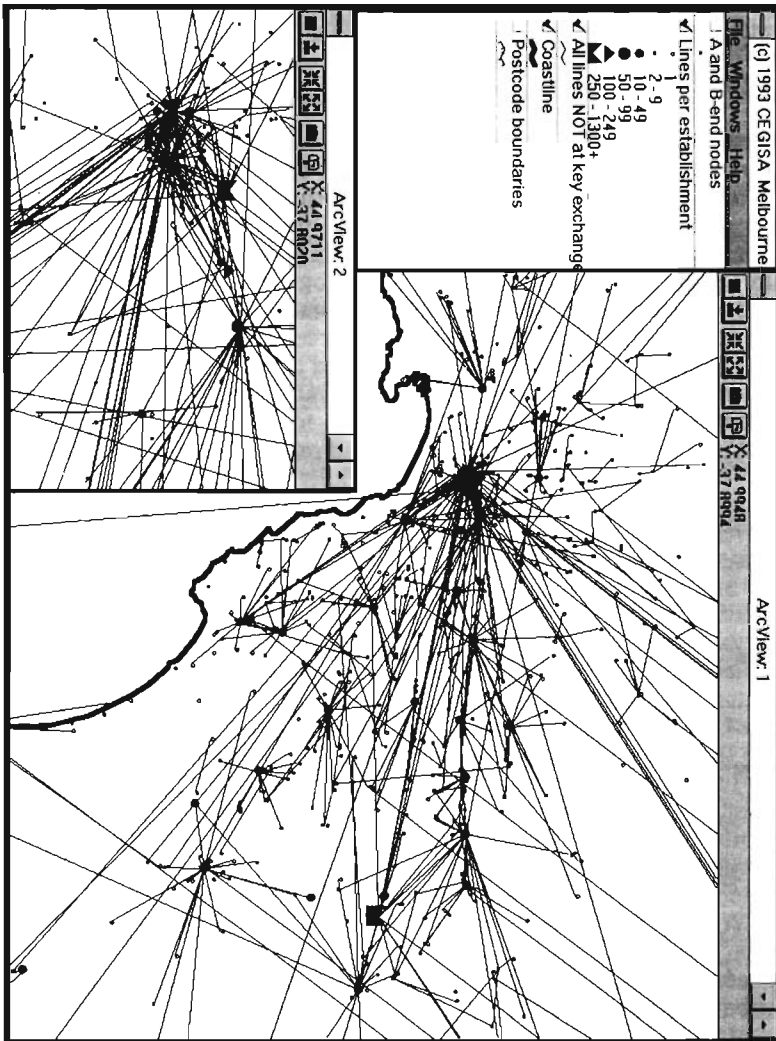
In addition to concentrations of information industries and information workers, we can add yet another layer to the innovative milieu that characterises particular regions within the major cities — that of telework. A number of writers have observed that while firms have historically brought people to work and relied heavily on organisational structure as the basis for operations and strategy it is now becoming possible for firms to consider bringing work to the employees — to consider a redesign of the organisation with the lessening of constraints on time and place.<sup>34</sup> Possibilities exist for both knowledge-based work as well as routine information collection, processing or distribution tasks to be relocated back to the home, re-establishing the link between work and residence that existed prior to the industrial revolution. The technological underpinnings for such a shift are the emergence of flexible, high speed communications networks and increasingly cheaper computing power. Communications and information technologies can effectively 'place' hardware and software, databases, knowledge bases and multimedia information which 'permanently' reside in capital city business establishments into homes in the suburbs or non-metropolitan areas. Voice services can also effectively provide an organisational umbrella for home-based operatives of telemarketing services.

There is considerable scepticism however, as to the likely future significance of telework.<sup>35</sup> It is also a particularly difficult phenomena to measure. Data identifying those suburbs within Melbourne where houses have on average more than one line to the local telephone exchange (indicative of some level of home-based telework activity, e.g., fax, modem)<sup>36</sup> suggest that a 'seedbed' capacity and associated

**FIGURE 7**  
**COLES MYER ESTABLISHMENTS, MELBOURNE 1992**



**FIGURE 8**  
**NATIONAL AUSTRALIA BANK COMMUNICATIONS NETWORK,**  
**MELBOURNE 1992**



infrastructure is being developed in these localities to accommodate the increasing variety of telematic activities capable of being undertaken within the home. For many it could be providing an extension of the day-time office into the residence for that class of employee who 'takes work home'. Again, these suburbs are mostly east and south of the city centre areas where education levels are higher than average for the city as a whole, where incomes are above average and where the highest concentrations of workers in Melbourne's information-intensive industries tend to reside.

## CONCLUSIONS

Research reported in this and earlier papers indicates that it takes time for new communications networks and telematic products to spread throughout a nation.<sup>1</sup> However, the frequency of appearance of new products and services and the speed of penetration into the business community is increasing over time, as product cycles shorten and as information and communication technology (ICT) becomes increasingly central to business activity. There appears to be a clear core-periphery trend in relation to diffusion of new products and services reflecting dominant market-pull effects, accentuated by a recent change in business philosophy of Australia's major telecommunications company following deregulation in the communications sector.

For telecommunications products and services which could be classed as 'mature' and where there is, generally speaking, universal access, patterns of availability do not equate directly with patterns of utilisation. Several of Australia's urban centres have levels of utilisation well above that which might be expected on the basis of their size of population or business base alone. This reflects a concentration of information-intensive industries in particular cities and underpins a proposition advanced by Moss that ICT is creating a new urban hierarchy which reflects the different concentrations of information-intensive industries nationally and internationally.<sup>2</sup> There appears to be some evidence in the USA that ICTs are changing the face of national settlement systems, yet in the UK they appear to be reinforcing the old order.<sup>3</sup> In Australia, ICTs do not appear to be disturbing the existing urban hierarchy to any great extent as yet. However, there are clear signs that Sydney is assuming world city status. Melbourne is struggling to keep pace with Sydney, yet is clearly in second place. Brisbane-Gold Coast, and, to a lesser extent, Perth, are staking their claims as rising stars.

Within the major cities, specific areas have emerged where concentrations of primary information industries are highest. A centralisation of upper management functions is taking place in key urban locations in key cities; CBDs are retaining their roles as control centres for medium- and large-sized organisations. Meanwhile, decentralisation of a wide range of information production, processing and distribution activities is occurring to particular sectors within cities



(there is a general failure of smaller urban centres and country regions to attract information industries in any significant number). A measure of functional and geographical centralisation is occurring with decentralisation for most corporations but not necessarily outside the cities as our case studies clearly indicate. There are strong moves by industry to locations favoured by information workers as places of residence. In this sector it is clear that jobs follow workers, generating an innovative milieu within those cities where new work practices (e.g., telework; inter-organisational alliances etc) are being employed and where new information industries will be spawned. These areas represent the economic engines of our Twenty-First century cities.

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33. GIS can be used to powerful effect in developing visualisation tools for examining how organisations are currently structuring their operations (who does what, where) and what communications networks are being used to support the various business functions of the organisation. A persistent problem confronted by research of this nature in the spatial sciences has been, first, the difficulty of adequately representing the structure of major organisations and their networks and, secondly, locating those operations within the wider social space framework which provides the geographical context of the organisation and its activities. Geographic information systems (GIS) now provides us with the means of doing both. GIS possesses the

functionality for configuring the communication network of a particular organisation, given data on each node and link in the network. Each node can be further characterised by the principal type(s) of economic activity undertaken at that location and each link can be differentiated in several ways according to the service type (e.g., ISDN, packet switched, PSTN/modem etc), network speed and volume of traffic. Clearly, an organisation's communications network should not be viewed in *vacuo*. Additional layers of information relating to such features as workforce location patterns — as indicative of labour market access; spatial pattern of personal taxable income — as indicative of disposable income; and metropolitan network infrastructure, can assist in understanding why organisations locate their operations in a particular fashion. GIS permits an overlay of an organisation's communication network onto a variety of *landscapes*: transport and communication networks (for distribution and access), suburb income (purchasing power), area occupational structure (labour market), industry profile (agglomeration potential) etc. GIS is a methodology offering an organisation-by-organisation approach for studies of the geography of business operations; as well as opportunities for aggregation and synthesis across organisations or comparative evaluation between firms within the same business sector; and the monitoring of change over time in the evolution of organisations and their communications networks (see P. W. Newton, J.R. Crawford, S. Ioannou, P. Bouchier and M. Katz-Even, 'GIS supports corporate network analysis', *Business Geographics*, 1(1), 1993, pp. 40-42, for more details).

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