23 Communications

Introduction 545

Telecommunication services within Australia 545

Carriers 546

Telstra 546

Optus 547

Vodafone 548

Service providers 548

Mobile phones 549

Household use of communications and related technologies 549

Postal communications 550

Australian Postal Corporation 550

Bibliography 552

Special Article — Household adoption of digital technologies 553

Introduction

The communication services industries encompass telecommunications, postal and courier services. These industries comprise Division J Communication Services of the Australian and New Zealand Standard Industrial Classification (ANZSIC). Communication Services is among the fastest growing industry sectors in Australia. It is estimated to have contributed between 3 and 4% to Australia's Gross Domestic Product in 1995–96.

Separate industry details for telecommunications, postal and courier services are not available from the ABS. Selected data from external sources for the telecommunications and postal services industries are included in this chapter under the appropriate headings; however no data are available on courier services.

Information on radio and television broadcasting, including the role of the National Transmission Agency, the Australian Broadcasting Corporation, the Special Broadcasting Service and commercial radio and television services, is included in *Chapter 11, Culture and recreation.*

Table 23.1 shows key measures of industry structure and performance for the Communication Services Division compiled from the ABS's annual Economic Activity Survey.

23.1 COMMUNICATION SERVICES INDUSTRIES — Structure and Performance

	Unit	1990–91	1991–92	1992–93	1993–94	1994–95
Industry structure						
Operating businesses	no.	300	300	700	1 200	1 600
Employment	'000	127	124	114	116	124
Income statement						
Sales of goods and services	$m	13 612	15 157	15 589	17 189	19 373
Less cost of sales	$m	4 270	4 743	5 610	6 223	7 275
Trading profit	$m	9 342	10 415	9 979	10 965	12 098
Plus interest	$m	318	212	112	97	148
Plus other operating income	$m	–20	85	371	167	245
Less labour costs	$m	4 221	5 048	5 146	5 486	6 355
Less depreciation	$m	1 891	2 190	2 182	2 338	2 538
Less other operating expenses	$m	83	42	75	171	195
Earnings before interest and tax	$m	3 446	3 432	3 059	3 235	3 403
Less interest expenses	$m	1 313	1 261	917	761	605
Operating profit before tax	$m	2 133	2 171	2 142	2 473	2 799
Total assets	$m	26 909	26 189	27 913	26 529	31 461
Total liabilities	$m	14 915	15 431	14 704	13 344	17 256
Net worth	$m	11 994	10 758	13 209	13 185	14 205
Capital expenditure	$m	3 315	4 161	3 821	3 296	2 332
Gross operating surplus	$m	5 440	5 570	5 120	5 669	6 045
Industry gross product	**$m**	**9 661**	**10 618**	**10 266**	**11 155**	**12 400**

Source: Business Operations and Industry Performance, Australia (8140.0).

Telecommunication services within Australia

The telecommunication services industry is defined to comprise those businesses mainly engaged in providing telecommunication services to the public, by wire, cable or radio.

As the ABS currently has no data separately available on this industry, selected data from external sources have been included in this section.

The section describes the industry in broad terms and distinguishes carriers from service providers. Statistics on the operations of the two general carrier organisations are included along with selected statistics on market shares in the basic voice services market, the resale revenue of service providers, and market shares in the digital and analogue mobile phone markets. ABS statistics on the household use of selected communications technologies are also provided.

An article discusses the adoption of digital technologies by households, based on analysis of data from an ABS survey of households.

Carriers

There are currently two licensed general telecommunications carriers in Australia, Telstra and Optus, and three mobile carriers, Telstra, Optus and Vodafone. This situation is to change from mid-1997 when restrictions on the number of carriers are to be removed as part of new, pro-competitive regulatory arrangements. Along with carriers, the industry also includes a number of service providers/resellers operating under the AUSTEL class licence system as well as a number of consultancy businesses.

Telstra

Telecom Australia and the Overseas Telecommunications Corporation merged on 1 February 1992 to operate as Australian and Overseas Telecommunications Corporation Ltd. The merged entity was renamed Telstra Corporation Ltd on 13 April 1993. Telstra is a general carrier, fully owned by the Commonwealth of Australia. It operates similarly to private sector companies, is profit driven and subject to the same taxation and government charges as a private sector company. Telstra reports to the Australian Stock Exchange and to the Australian Securities Commission as a public company. Telstra provides both domestic and international services in competition with the other licensed carriers.

Telstra operates a full range of telecommunications facilities including:

- network access;
- equipment on customer premises;
- services for local, long distance and international calling and for cellular mobiles;
- advanced business and value added services ;
- operator assisted and directory services and products;
- pay-phones;
- payment cards;
- operator-assisted services;
- data services;
- broadband, broadcast and maritime services;
- Internet access;
- fault repair services; and
- billing services.

Telstra has introduced new telecommunications services and has moved to enter new markets such as pay TV and multimedia. Telstra is rolling out its broadband cable network which provides a platform for new services (including interactive on-line services). Telstra's cable rollout is aimed at passing more than four million homes by 1999. The cable network is expected to be one of the most advanced of its kind in the world and one of the first to deploy leading edge digital technology offering the capacity for a new generation of services and applications in education, commerce, government services, leisure and other industries.

Telstra's cable TV services are provided by FOXTEL, a joint venture between Telstra and News Limited. The service offers more than 20 channels of movies, sports, news, children's and multicultural programs. Telstra's broadband network is also being used to provide high speed Internet access using cable modem technology.

Telstra has also established 'Telstra on Australia', an Internet service provider, and introduced 'Big Pond', a range of products designed to make the Internet easily available to Australia's PC users.

Telstra is taking a leading role in the development of common architecture for delivery of multimedia services and standards for providing video on demand and interactive services. The standards and specifications are being developed by an international group, the Digital Audio Visual Council (DAVIC), and will be used by telephone, cable and other information

23.2 TELSTRA — SUMMARY OF FINANCIAL RESULTS

Item	1991–92 $m	1992–93 $m	1993–94 $m	1994–95 $m
Revenue	12 229	12 656	13 363	14 081
Expenses (including abnormals)	11 570	10 662	10 835	11 676
Operating profit before tax	658	1 994	2 528	2 405
Income tax	345	1 090	823	650
Operating profit (after tax and minority interest)	300	905	1 699	1 753
Dividends	478	674	738	944
Capital expenditure	3 015	2 589	2 466	3 222
Total assets	22 827	23 160	21 139	24 083
Debt	8 922	7 717	5 901	6 149
Shareholders' equity	9 905	10 886	10 756	11 727

Source: Telstra Annual Report 1995.

delivery companies as a catalyst for creating open networks and systems for broadband distribution of video programming and other interactive activities.

Table 23.2 shows key financial results for Telstra over the four financial years 1991–92 to 1994–95.

Telstra's dividend to the Commonwealth Government increased from $738m to $944m in 1994–95. Together with interest and taxes, the Commonwealth Government received $2,472m from Telstra's operations during 1994–95.

Telstra employed 76,322 full-time staff at 30 June 1996.

Optus

In November 1991, the Government announced that Optus Communications Pty Ltd would be the second general telecommunications carrier. Optus is a publicly listed company whose services include:

- services for long distance and international calling and for cellular mobiles;
- operator services;
- video and data services;
- broadcast services;
- value added network services;
- business services such as centrex, virtual private networks, and enhanced toll-free services;
- satellite services;
- private leased line services; and
- billing services.

Optus commenced mobile, long distance and international calling services in competition with Telstra during 1992. In September 1994 it introduced a satellite-based mobile communications system. The provision of Optus services is based on its optical fibre cable network, its digital cellular mobile network and the national satellite system, together with interconnection rights to other carriers' networks (on a payment basis).

Optus is a participant in the Optus Vision joint venture which is continuing the process of rolling out an overhead optical fibre network which will support pay TV, FM radio, video on demand, local telephone access and calls, and interactive services.

Table 23.3 shows key financial results for Optus for the year 1995–96. These results feature a first annual profit of $60m and earnings before interest, tax, depreciation and amortisation of $456m (with depreciation, amortisation and interest expenses accounting for $397m in total).

23.3 OPTUS — SUMMARY OF FINANCIAL RESULTS

Item	1995–96 $m
Revenue	1 944
Expenses	1 488
Gross earnings	456
Depreciation, amortisation and interest	397
Operating profit before tax	60
Capital expenditure	661
Total assets	2 800
Shareholders' equity	2 000

Source: Optus Communications.

Optus revenue for 1995–96 of $1,944m represented a 36% increase over the 1994–95

result of $1,435m. The main contributors to revenue were:

- long distance (42%);
- mobile services (39%);
- business network services (12%); and
- mobile equipment (7%).

Payments for connections to other networks such as Telstra and overseas carriers reduced as a proportion of revenue as more calls were carried on the Optus network. Carrier payments were equivalent to 34% of revenue for 1995–96, down from 40% for the previous year.

Optus now has an asset base of $2.8b. Capital expenditure for 1995–96 was $661m (excluding investment in Optus Vision). To date, Optus has invested $3.5b in licence payments and capital projects.

Optus Vision began offering pay TV services on 20 September 1995 and local call services on 28 June 1996. Optus Communications' direct investment in Optus Vision was $372m at 30 June 1996, which is more than half of the $605m it has committed to invest in Optus Vision by June 1997.

Vodafone

Vodafone is licensed to provide mobile telecommunications services, which it commenced in 1993. The company has highlighted its position as a specialist supplier of digital mobile communications.

The services offered by Vodafone as part of its mobile service include:

- directory assistance,
- message taking;
- call forwarding, and
- call barring.

As the holder of a mobile carrier licence, Vodafone installs and operates its own facilities for the provision of cellular mobile services. The facilities include base stations, switches, towers and cable. Vodafone uses Telstra facilities to access the fixed network.

Service providers

AUSTEL's class licences allow any person to provide a range of telecommunication services without requiring suppliers of a service to apply for an individual licence, provided that they comply with the provisions of the licence. The Service Providers Class Licence (SPCL) allows any person to use telecommunications capacity acquired from Telstra or Optus, or in defined circumstances derived from non-carrier infrastructure, to supply a range of local or national telecommunication services to consumer and commercial markets, including public switched voice, data and value-added services, and private network services.

Resale involves the acquisition of telecommunications capacity in the form of services from a carrier and the supply of these services to third parties. A switchless reseller uses the carriers' switches and tariffed services to provide a similar type of service. A switched reseller has its own switches and network facilities, and leases line capacity from the carrier. It is able to supply additional services which significantly change the nature or characteristics of the service acquired from the carrier. Table 23.4 shows the revenue from the resale of telecommunication services in 1995 and 1996.

23.4 RESALE REVENUE

Item	1995 $m	1996 $m
Total resale revenue	500	700
less margin to carriers	–400	–560
Net value resale	**100**	**140**

Source: Paul Budde Communications Pty Ltd, Telecommunications Strategies Report 1996–97.

According to Paul Budde Communications Pty Ltd, the number of telephone service providers (resellers) dropped from around 100 in 1995 to between 30 and 40 in 1996, with the top 10 companies enjoying a 90% market share.

23.5 MARKET SHARES FOR BASIC VOICE SERVICES (INCLUDING MOBILE)

Item	1995 %	1996 %
Operators		
Telstra	93	87
Optus	5	10
Vodafone and resellers	2	3
Total	**100**	**100**

Source: Paul Budde Communications Pty Ltd, Telecommunications Strategies Report 1996–97.

Mobile phones

The digital mobile market is expected to be a major growth area in 1997 and beyond due to deregulation of the telecommunications market and the expected entry of more competitors. Tables 23.6 and 23.7 show the approximate market shares for both digital and analogue services.

23.6 DIGITAL MOBILE MARKET — July 1996

Item	Subscribers no.	Market share %
Telstra	350 000	38
Optus	350 000	38
Vodafone	220 000	24
Total	**920 000**	**100**

Source: Paul Budde Communications Pty Ltd, Telecommunications Strategies Report 1996–97.

23.7 ANALOGUE MOBILE MARKET

Period	Subscribers no.	Telstra MobileNet %	Optus %
July 1995	2 068 331	70.3	29.7
August 1995	2 126 595	70.0	30.0
September 1995	2 185 272	69.9	30.1
October 1995	2 299 388	71.0	29.0
November 1995	2 357 420	70.7	29.3
December 1995	2 549 243	70.6	29.4

Source: Telstra MobileNet.

The Government has announced its commitment to phasing out the Analogue Mobile Phone Service (AMPS) mobile phone network by 1 January 2000, subject to appropriate safeguards, including possible retention of spectrum in rural areas with inadequate mobile coverage.

Currently the overall coverage for digital mobiles, based on the Global System for Mobile Communications (GSM), is comparable with that for analogue mobiles, and is beginning to overtake analogue's coverage. Analogue is available to 91% of the Australian population. According to advice from the carriers, GSM digital coverage is: Telstra 90% and Optus 86%. Vodafone reported 78% population coverage in June 1996 and expects to achieve 80% population coverage by the end of 1996. Optus and Vodafone have digital coverage at some locations currently not covered by Telstra. While user numbers are currently higher for AMPS (2.7 million) than for digital (1.2 million), the number of digital users is growing at a much greater rate than the number of analogue users.

Household use of communications and related technologies

In February 1996 the ABS conducted a survey which sought to measure the uptake of information and telecommunications technologies by households. The results for selected communications technologies are shown below.

23.8 HOUSEHOLDS OWNING/PAYING FOR SELECTED COMMUNICATIONS TECHNOLOGIES — February 1996

	Unit	Capital cities	Remainder of Australia	**Total Australia**
Facsimile machine				
Dedicated line	%	3.0	3.0	**3.0**
Other connection	%	7.4	5.8	**6.8**
Total households	%	9.9	8.1	**9.2**
Mobile phone	%	27.5	18.5	**24.1**
Car phone	%	4.3	4.3	**4.3**
Cordless phone	%	15.0	10.8	**13.4**
Answering machine	%	29.5	18.6	**25.4**
Pager	%	3.1	1.4	**2.4**
Voice mail	%	4.0	*1.2	**3.0**
Pay TV(a)	%	4.1	*1.3	**3.0**
None of the above	%	47.3	61.0	**52.4**
Telephone connected	%	97.8	95.2	**96.8**
Total number of households	'000	4 173	2 472	**6 645**

(a) Pay TV services are not widely available in all areas of Australia.

Source: Household Use of Information Technology, February 1996 (8128.0).

Of particular note in table 23.8 is the high uptake rate for mobile phones (24% Australia wide). The proportion of capital city households with a mobile phone is appreciably higher, 27.5% than the proportion of such households in the remainder of Australia, 18.5%.

Answering machines also appear to be popular with householders, demonstrated by the 25% uptake Australia wide. Again, the difference between capital city dwellers and the remainder is pronounced, with 29.5% and 18.6% uptake respectively. In comparison to answering machines, voice mail services are not highly popular, with just 3% of households subscribing.

While nearly 97% of households had a telephone connected, over 52% of households did not own or pay for any of the other technologies listed in the table.

Postal communications

Australian Postal Corporation

The Australian Postal Corporation (trading as Australia Post) is a government business enterprise owned by the Commonwealth of Australia. It operates under the *Australian Postal Corporation Act 1989*. Australia Post is independent of Government funding, achieves a substantial profit from its activities and pays a full range of taxes and charges as well as allocating 60% of its after-tax profits as a dividend to the Government.

Australia Post offers letter and parcel delivery services within Australia and internationally. It also provides a range of related services including: electronic bulk mail handling, advertising mail, bill payment, money order and banking services, express delivery services and philatelic products and services.

Australia Post's legal obligations require it to:

- provide Australians with a universal letter service;
- carry standard letters within Australia at a uniform price;
- ensure that the letter service meets the social, industrial and commercial needs of the community;
- perform its functions according to sound business practice; and
- perform its functions consistent with general policies of the Commonwealth Government.

Financial and other operating statistics are shown in the tables below.

23.9 AUSTRALIAN POSTAL CORPORATION — Profit and Loss Statement

	1990–91 $'000	1991–92 $'000	1992–93 $'000	1993–94 $'000	1994–95 $'000
Revenue					
Mail services	1 966.6	2 099.9	2 211.2	2 321.7	2 487.3
Philatelic sales	41.5	41.4	38.6	45.1	47.6
Commission on agency services	89.9	91.5	99.8	115.5	142.7
Postal money order services	21.6	25.8	24.8	25.3	26.2
Other revenue	63.8	51.5	46.2	60.8	79.6
Total	**2 183.5**	**2 309.8**	**2 420.5**	**2 568.4**	**2 783.4**
Expenditure					
Labour and related expenditure	1 323.3	1 331.5	1 346.4	1 380.2	1 441.2
Carriage of mail by contractors	172.2	172.3	167.3	177.8	190.9
Accommodation	124.1	120.8	114.9	111.9	115.8
Stores and supplies	106.1	119.2	119.7	148.7	145.8
Depreciation	54.3	69.5	92.9	81.4	105.7
Interest	2.4	3.5	2.6	4.9	18.3
Ongoing restructuring costs(a)	..	..	53.5	64.2	42.1
Post Office agents and Licensees(a)	..	..	65.7	101.5	119.3
Other operating expenditure	254.9	317.1	211.1	213.9	271.2
Total	**2 037.3**	**2 133.9**	**2 174.1**	**2 284.5**	**2 450.3**
Operating profit	**146.2**	**175.9**	**246.4**	**283.9**	**333.1**

(a) Not separately itemised before 1992–93 but included in 'Other operating expenditure' as appropriate.

Source: Australian Postal Corporation.

23.10 AUSTRALIAN POSTAL CORPORATION — Persons Engaged in Providing Postal Services

							30 June 1995		30 June 1994
	HQ	NSW/ACT	Vic./Tas.	Qld	SA/NT	WA	Sprintpak	Aust.	Aust.
Full-time staff									
Permanent	466	11 818	8 933	4 174	2 355	2 279	125	30 150	29 551
Temporary	9	615	426	145	71	205	..	1 471	1 579
Total full-time staff	*475*	*12 433*	*9 359*	*4 319*	*2 426*	*2 484*	*125*	*31 621*	*31 130*
Part-time/casual staff									
Part-time staff	3	1 685	1 314	751	340	408	..	4 501	4 204
Casual	..	409	229	212	232	179	46	1 307	1 034
Total part-time/casual	3	2 094	1 543	963	572	587	46	5 808	5 235
Agency									
Post Office agents	..	3	1	2	..	..	..	6	325
Other full-time	..	13	..	2	..	..	..	15	162
Other part-time	..	7	..	..	..	..	..	7	145
Total agency engagements	..	23	1	4	..	..	..	28	632
Mail contractors	..	1 324	732	1 192	392	278	..	3 918	3 960
Total	**478**	**15 874**	**11 635**	**6 478**	**3 390**	**3 349**	**171**	**41 375**	**40 960**

Source: Australian Postal Corporation.

23.11 AUSTRALIAN POSTAL CORPORATION — Mail Delivery Network and Post Offices

						30 June 1995	30 June 1994
	NSW/ACT	Vic./Tas.	Qld	SA/NT	WA	Aust.	Aust.
Households receiving mail	2 428 415	1 876 000	1 289 002	665 330	655 806	6 914 553	6 733 176
Businesses receiving mail	269 047	212 676	139 415	68 011	66 308	755 457	738 768
Total delivery points	2 697 462	2 088 676	1 428 417	733 341	722 114	7 670 010	7 471 944
Australia Post Outlets	1 296	1 296	746	538	441	4 317	4 342

Source: Australian Postal Corporation.

23.12 AUSTRALIAN POSTAL CORPORATION — Total Postal Articles Handled

	1990–91 million	1991–92 million	1992–93 million	1993–94 million	1994–95 million
Posted in Aust. for delivery in Aust.	2 976.7	3 019.2	3 135.2	3 317.9	3 529.9
Posted in Aust. for delivery overseas	111.4	112.7	130.1	146.0	146.4
Posted overseas for delivery in Aust.	126.7	133.3	150.4	147.3	151.4
Total articles through mail network	**3 214.8**	**3 265.2**	**3 415.7**	**3 611.3**	**3 827.7**

Source: Australian Postal Corporation.

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Household adoption of digital technologies

(This article has been contributed by Jen St. Clair and Jen Muir, Bureau of Transport and Communications Economics.)

Introduction

There is strong private and public sector interest in the diffusion of consumer technologies. Forecasts are often attempted — and are often wrong.

In the case of networked, online services, forecasts are particularly difficult, not least because of the dynamic and complex relationship between supply and demand forces which applies to all services delivered via a network infrastructure (see BTCE, 1995).

In the private sector, attempts at forecasting generally focus on identifying the socio-demographic characteristics of households which are most likely to enter the market in the short term. Public sector attention also encompasses that group least likely to be able to access commercially provided digital technologies — a group sometimes described as an information underclass.

In response to concerns about development of such a group, the Bureau of Transport and Communications Economics (BTCE) initiated a project in 1996 called *Access to Information and Communications Services*. This project aims to develop an analytical framework for examining the rationale and costs of public policies to minimise barriers to accessing online services from home. The central research questions are:

- Are particular community groups likely to miss out on commercial provision of particular online services?
- If so, should their lower levels of take-up be a concern for government?
- What would it cost to assure their access?
- Who should pay, and by what means?

The analysis presented here of ABS data on digital technologies in the home seeks to address the first of these questions, and thereby to demonstrate the value of linking responses to several innovative ABS survey questions by means of a simplified, diagrammatic form of multivariate analysis called a tree diagram.

The ABS survey

The first ABS household survey on the use of information technology (IT) in the home was carried out in 1994. The results indicated marked differences in adoption of computers between households of different socio-demographic types. For example, at that time 47% of households in the top income quintile had a computer, compared with only 5% of those in the lowest quintile (ABS, unpublished data).

In response to strong private and public sector interest in its data, the Small Business, Science and Technology Section of the ABS then embarked on an expanded household survey program. At the end of a four-stage survey cycle the 1996 data set will consist of 12,000 observations. The first results, from the February 1996 sample of 3,000 households, were published in September (ABS, 1996). This article is based on analysis of previously unpublished results from a combined data set consisting of the February and May 1996 survey results.

Digital connectivity

As a first step in the analysis presented here, the estimated 6.6 million Australian households were classified into one of four groups, on the basis of the presence or absence of the three technologies currently required to access digital services from home:

- the telephone,
- the personal computer, and
- the modem.

The relative sizes of these four groups are shown in table S3.1, which highlights the fact that the majority of Australian households are not yet 'being digital' — to use the phrase coined by one commentator on the information economy (Negroponte, 1995).

S3.1 DIGITAL CONNECTIVITY

Digital connectivity category	Functional capabilities	Estimated number of households ('000)	%
Telephone unconnected			
No telephone, no computer, no modem	No telecommunication	222	3.4
Telephone connected			
Telephone, no computer, no modem	Voice communication	4 380	66.4
Digital unconnected(a)			
Telephone, computer, no modem	Voice communication and stand-alone computing	1 512	22.9
Digital connected			
Telephone, computer, modem	Voice/data communication and networked computing	486	7.4
All households	—	**6 600**	**100.0**

(a) Digital unconnected total includes 42 000 households which had a computer but which did not know if they had a modem.
Source: BTCE estimates, based on unpublished ABS data.

Indeed, the February/May 1996 data set indicates that the nearly 70% of all households lacked at least two of the three prerequisites for accessing digital data from home, namely computers and modems.

The February/May 1996 results show that the proportion of households which had already become digital was 30.3%, compared with 23% two years earlier. Are such increases, of the order of 10–15% per year, likely to be sustained? What proportion of Australian households might be expected to be digital in two years time?

To answer these questions, it is tempting to try to look into the future using straight line projections. For example, if the changes observed over the last two years were projected into the next two years, we would see:

- an increase in the proportion of households which use a computer at home from 30.3% to 40.1% in 1998; and
- an increase in the proportion of households with a computer and modem from 7.4% to 14.0%.

However the history of diffusion of many new consumer technologies suggests that straight-line projections are unlikely to be very good predictors. This is mainly because not all products achieve the rapid growth associated with mass market take-up, so that the diffusion curve only acquires its familiar S-shape in the case of stable and successful products or services, such as the VCR. The availability of only two data points (for 1994 and 1996) means that it is not yet possible to identify changes in the rate of growth in adoption, and therefore to identify the current stage of market diffusion of digital technologies. Without this information, estimates of future demand can only be carried out through comparison with analogous products (see BTCE 1994).

With such caveats in mind, the projection frame proposed for this BTCE analysis is deliberately short (i.e. 1996–98). The purpose of the projection is not to generate forecasts as such — an assessment of market developments likely to influence take-up rates is beyond the scope of the analysis — but rather:

- to assess the potential for aggregate household use of digital technology to increase significantly in the short term; and
- to identify the characteristics of groups most likely to be left behind in the transition to a digital era.

Analysis

The pool from which new computer-using homes will be drawn is the four and half million or so households which the February/May data set indicates did not use a computer (i.e. 70% of 6.6 million households).

Growth scenarios have been based on links between responses by these non-digital households to three ABS survey questions which relate to:

- intention to spend on computer equipment in the next 12 months;
- reason why a household does not have a computer or modem; and

- interest in specified online services.

These questions are each briefly described in the following section.

Intention to spend

In these surveys, the ABS asked whether anyone in the household planned to purchase, upgrade or replace any of their computer equipment, including software, within the next 12 months or two years. The predictive power of responses to this question from the February/May 1996 surveys can be gauged by comparing the actual penetration rate in February 1996 with the rate that would have been achieved if non-computer households which in February 1994 reported plans to purchase actually acquired a computer. The actual penetration rate achieved in February 1996 was 29.6% and the rate that would have occurred if the plans to purchase within the next 12 months from February 1994 were fully realised was 31.3%. By contrast, spending intentions at February 1994 with a two year period, rather than one year period, significantly overstated actual penetration, since they yield a predicted rate of 37.2%.

Comparisons of 1994 and 1996 data sets suggest therefore that householders predict more accurately their actual purchase of computer equipment over the shorter of the two time frames.

When the combined February/May data set is considered in a similar way, the 12 month spending intentions question yields a penetration of 31.6%, compared with the actual penetration rate of 30.3%.

Reasons for not having computer and/or modem

The 1996 ABS survey sought, for the first time, information about reasons for householders' decisions not to acquire computers or modems. Respondents in households without a computer (or in the case of modems, with a computer but no modem) were asked to nominate one main reason for non-adoption from the following list:

- Costs too high
- Computers a bad influence
- No one in household interested
- No one in household knows how to use one
- Have no use for one
- Have access to a computer elsewhere
- Other (specify)

These stated reasons offer some clues into factors which would need to change for households to acquire either a computer or a modem. The BTCE's analysis of non-computer using households involves grouping together households for which there is a stated lack of interest, or perceived lack of use for a computer, or a lack of skills, and distinguishing this group from those which state that cost, or access elsewhere (e.g. in the workplace) is the reason for not having a home computer. This division is based on the following two assumptions.

First, households for whom a lack of interest in, or perceived lack of use for, computers is the main barrier must be viewed as much less likely to purchase computers and/or modems even if costs fall.

Second, households for whom cost is the main barrier to equipment acquisition may be assumed to be willing to purchase computers or modems in principle, but to be subject to a binding financial constraint. Such constraints are likely to weaken as the costs of computing equipment fall in real terms, standards become established and a greater emphasis on the residential market by suppliers makes purchasing easier (and less risky) for consumers.

On the basis of these two assumptions, responses to the question about stated reasons for lack of past purchases are used in the analysis as an additional filter on the division of the non-digital population into those who intend to spend and those who do not.

Interest in online services

Information was also sought for the first time in the 1996 survey on interest in a range of online services. All households, irrespective of whether or not they used a computer, were asked whether they would consider using a television or computer for home-based shopping, banking, gambling and/or staying in touch with people or finding things out via electronic mail (e-mail). They were asked to ignore cost considerations for the purpose of the exercise.

The ABS survey aimed to avoid associations with particular technology platforms by asking respondents to consider whether they would be interested in the services delivered by means of a television or computer.

Tree analysis

The various permutations of responses to the three questions referred to above can be examined systematically using tree analysis.

In this analysis, the more important the attribute, the closer it is to the top of the diagram (see Aitkin 1982 for a discussion of an Australian application of this form of analysis, which is useful for depicting complex relationships between socio-demographic attributes which are themselves strongly co-correlated. See Sonquist, Baker and Morgan 1971 for the methodology.) Therefore, since intention to spend already has demonstrated predictive power, households were first divided using responses to this question as the first discriminant.

The best ordering of the other two ABS questions — both of which were asked for the first time in 1996 — could not be determined without analysis to test the extent to which binary division of each group, using the response to a particular survey question, reduced variance in the sample. However, such statistical analysis is not readily carried out without access to data in electronic format. Therefore, reason for non-adoption was ranked as the second discriminant, on the basis that these responses are based on past, actual behaviour — in contrast to interest in online services, which is necessarily speculative about future interest in services which are likely to be unfamiliar to most households.

The next section presents the results of the tree analysis and is followed by a description of how the results may be used to assess the likelihood of different groups of households acquiring computers in the short term.

Results

In diagram S3.2, a classification of non-computer using households is depicted, in which they are grouped on the basis of spending intentions, reason for not having a computer at home and interest in online services. At each branch of the tree, the number of households and the proportional split between the two branches at the same horizontal level is shown.

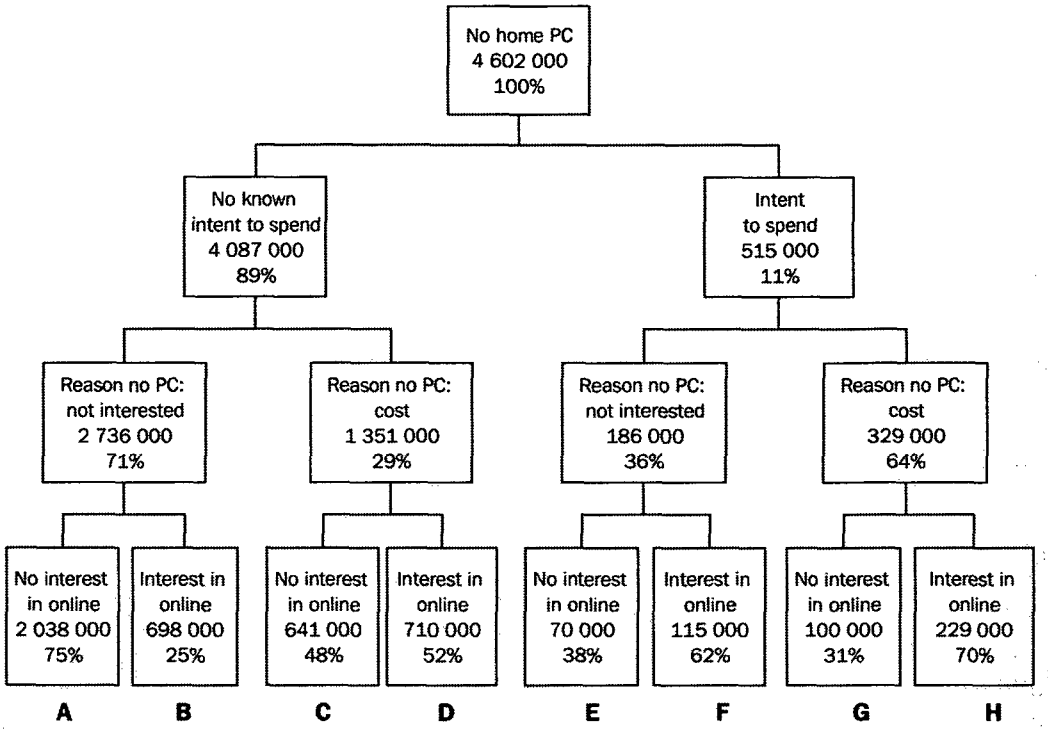
Figure S3.2 shows how the 70% of households which the February/May data set indicates did not have a computer at home responded to the three ABS questions considered here. For example, working down the left hand side of the tree:

- nine out of ten of these households did not intend to spend anything on computer equipment in the next 12 months;
- more than two-thirds of this group with no spending intentions cited one of a number of reasons relating to lack of interest in computers as the reason for not having one at home;
- around three-quarters of this group which had no spending intentions and also lacked interest in computers, expressed no interest in any of the four specified online services, regardless of cost and the choice of either TV or PC delivery platform (Cell A in diagram S3.2).

In general, a stated intention to spend on computers seems to be linked with a response which cites cost or access elsewhere as the reason for not having acquired a computer to date: households with spending intentions are more than twice as likely to give this reason than those with no spending intentions (i.e. 64% compared with 29%).

However, the nature of links between future spending intentions and reasons for past non-adoption on the one hand and interest in online services on the other is not always so clear cut (and will be the topic of further BTCE analysis). For example, Cell B contains households which were interested in at least one online service — despite lack of computer expenditure plans and despite citing lack of interest as the main reason for not having acquired a computer. This group of around 0.7 million households therefore looks likely to include households which might seek to access services through a TV set-top box combination rather than through a PC/modem.

S3.2 STATED PAST AND FUTURE MARKET BEHAVIOUR OF NON-COMPUTER USING HOUSEHOLDS



Source: BTCE estimates, based on unpublished ABS data.

Probability of acquiring a computer

Table S3.3 summarises a systematic allocation of each cell in diagram S3.2 into groups with descending likelihood of acquiring a computer over the next two years. The percentages shown in the final column highlight the relatively small size of those groups which have been assigned the highest probability of acquiring computers (eg 3.5% in Cell H, compared with 30.9% in Cell A).

S3.3 SCENARIOS FOR GROWTH IN COMPUTER-USING HOUSEHOLDS

Intend to spend	Cost as main barrier	Interest in online services	Cell identifier (see S3.2)	Likelihood of acquiring PC in two years	Proportion of all households (%)
Yes	Yes	Yes	H	Most likely	3.5
Yes	Yes	No	G		1.5
Yes	No	Yes	F		1.7
Yes	No	No	E		1.1
No	Yes	Yes	D		10.8
No	Yes	No	C		9.7
No	No	Yes	B		10.6
No	No	No	A	Least likely	30.9

Source: BTCE estimates, based on unpublished ABS data.

Diffusion scenarios

In developing growth scenarios, the existing population of home computer users (nearly two million households) is used as a lower bound on the likely penetration in 1998. Scenarios of higher adoption are then derived by adding in groups which have different combinations of spending intentions, reasons for non-adoption and levels of interest in online services, as summarised in table S3.4. Households most likely to acquire a computer are assumed to be those reporting plans to spend on computer equipment within the next 12 months; table S3.4 shows that over half a million households were in this category.

S3.4 POTENTIAL FOR GROWTH IN HOUSEHOLD COMPUTER USE — 1996–98

Household characteristics	Cell identifier (see S3.2)	Number of households(a) '000	Cumulative total '000	Proportion of households using PCs at Feb/May 96 %
Households with computers as at Feb/May 96	—	1998	1998	30.3
Households without computers -				
Planning computer expenditures	E+F+G+H	515	2513	38.1
Not planning computer expenditures -				
Cost reason no computer; interested online services	D	710	3223	48.8
Cost reason no computer; not interested online services	C	641	3864	58.6
Lack of interest reason no computer; interested online services	B	698	4562	69.1
Lack of interest reason no computer; not interested online services	A	2038	6600	100

(a) Household numbers shown to the nearest thousand, hence small rounding errors.

Source: BTCE estimates based on unpublished ABS data.

If all these non-computer-using households currently planning to make computer expenditures within 12 months were to acquire a computer by 1998, the household computer penetration rate would rise from 30.3% to 38.1% (compared with an estimate of 40.1% from straight line projection). Higher penetration would imply the addition of households with no current plans for computer expenditures.

In this analytical framework, those least likely to acquire a computer are those with no known computer spending intentions, which report lack of interest in computers as the reason for not having one at home and which are currently uninterested in using online services. More than two million households satisfied these criteria (i.e. around 30% of all Australian households).

To reiterate, the reason why this latter (very large) group has not acquired and does not intend to acquire digital technology is not cost-based. Rather it is based on lack of interest in both computers and the online services which they deliver to the home. This suggests that a realistic upper bound on household penetration of digital technologies is 70%, in the medium term at least (although of course, the least likely group might become willing to acquire digital technologies if, or when, a large proportion of everyday transactions like bill paying becomes available significantly more cheaply or conveniently online).

If the cost constraint were to be reduced — as is possible through economies of scale as computers achieve more widespread adoption — the scenario analysis suggests that penetration could increase by a further 10% or so to around 49%.

In the short term, a scenario in which a majority rather than a minority of Australian households became digital could only take place if price reductions were combined with more compelling applications than those described to survey respondents, or alternatively higher awareness of their relevance.

In the longer term, increasing IT literacy within Australia will also affect the degree of penetration of computers into homes.

The next step in the analysis is to examine the socio-demographic characteristics of the half million or so households identified as most

likely to become digital, and compare these characteristics with those of the two million or so households least likely to do so.

Future diffusion pathways

As noted above, the two projection methods discussed (i.e. straight-line projections and those based on the tree analysis) generate very similar results at the aggregate level, (40.1% and 38.1%, respectively). However, when the most likely and least likely groups identified using the tree analysis are examined more closely, it is clear that different types of households have very different propensities to become digital.

Table S3.5 shows, for example, that households in the lowest income quintile constituted only 6.2% of the most likely group, but were 34.9% of the least likely group. The table also shows how these two groups are distributed between households of different structure: clearly, those with children are much more strongly concentrated in the most likely group (they make up almost half of the group), while households which included people over the age of 60 years are poorly represented (less than 3%), but make up more than half of the least likely group. Households in non-metropolitan areas and those without a home business are both relatively over-represented in the least likely group.

S3.5 CHARACTERISTICS OF HOUSEHOLDS MOST AND LEAST LIKELY TO ADOPT COMPUTERS BETWEEN 1996 AND 1998

	Households most likely to acquire a PC by 1998(a)		Households least likely to acquire a PC by 1998(b)	
Household characteristics	'000	share(c) %	'000	share(c) %
Household income quintile(d)				
Low	28	6.25	595	34.9
Lower middle	83	18.4	557	32.6
Middle	98	21.7	281	16.5
Upper middle	127	28.2	156	9.1
High	115	25.5	119	6.9
Household structure(e)				
Couple without children	76	14.7	197	9.7
Couple with children	240	46.5	298	14.6
Single parent	58	11.2	96	4.7
Single person	65	12.7	222	10.9
Older person(s)	14	2.7	1 068	52.4
Group/extended family	62	12.1	157	7.7
Location of household				
Metropolitan	362	70.4	1 154	56.6
Non-metropolitan	153	29.6	884	43.4
Presence of home business				
Home business	95	18.5	178	8.7
No home business	420	81.5	1 860	91.3
Total	515	100.0	2 038	100.0

(a) Households where a computer was not used at home at Feb/May 1996 but which intended to spend on computers or computing equipment within 12 months. (b) Households where a computer was not used at home at Feb/May 1996; which had no plans for computer or computer-related expenditure; which claimed that lack of interest in computers, lack of use for a computer, or lack of skills to use one were the reasons for the household not having a computer; and which expressed no interest in online services. (c) Proportion of households most/least likely to acquire a computer originating from each category. (d) Does not add to 100% because excludes households not classified to a quintile (no income recorded); see St Clair et al (1996) for income ranges. (e) See St Clair et al (1996) for composition of each household structure grouping.

Source: BTCE estimates, based on unpublished ABS data.

What if all the households in the most likely group were to acquire a computer over the next two years? What would the penetration rates be among the groups listed in table S3.5?

Table S3.6 shows that by 1998 penetration rates could exceed 50% among upper middle and high income households, at a time when those in the lowest income quintile could still have penetration rates closer to 10%. Similarly, more than 50% of households consisting of couples

with children could have a computer by 1998, by which time less than 10% of households made up of older people could be similarly equipped.

When compared with similar disaggregations for the February/May 1996 data, the estimates in table S3.6 of the distribution of computer-using households in 1998 suggest a continuing steady increase in takeup among lower-middle and middle income households. This would result in a slight narrowing of disparities along income lines (i.e. from a 6.4 fold disparity between penetration in the lowest and highest income groups, to a 5.9 fold disparity), as takeup among these groups increases faster than among high income households — albeit from a lower base. This would be inconsistent with findings in the United States where such disparities are reported to be widening (RAND 1995).

S3.6 MOST LIKELY COMPUTER PENETRATION IN HOUSEHOLDS, By 1998

	Households with a PC at Feb/May 1996		Households most likely to acquire a PC by 1988(a)	Most likely PC penetration(b)	
Household characteristics	'000	%	'000	'000	%
Household income quintile(c)					
Low	85	8.5	28	113	11.3
Lower middle	225	16.8	83	308	23.1
Middle	341	28.7	98	439	37.0
Upper middle	485	44.3	127	612	55.9
High	530	54.5	115	645	66.4
Household structure					
Couple without children	268	34.5	76	344	44.3
Couple with children	1 092	45.4	240	1 332	55.4
Single parent	176	30.1	58	234	39.9
Single person	138	19.2	65	203	28.4
Older person(s)	104	7.3	14	118	8.3
Group/extended family	221	31.8	62	283	40.7
Location of household					
Metropolitan	1 403	62.2	362	1 765	43.0
Non-metropolitan	595	37.8	153	748	30.0
Presence of home business					
Home business	489	50.7	95	584	60.6
No home business	1 509	26.8	420	1 929	34.2
Total	**1 998**	**30.3**	**515**	**2 513**	**38.1**

(a) The group of households most likely to acquire a computer by 1998 as that group without a PC at February/May 1996, which indicated an intention to spend on computers or computing equipment within 12 months. (b) The most likely PC penetration in households by 1998 is formed by summing the groups which had a PC at February/May 1996 and the group most likely to acquire a PC by 1998. (c) Does not add to 100% because excludes households not classified to a quintile (no income recorded) — see St Clair et al (1996) for income ranges.

Source: BTCE estimates, based on unpublished ABS data.

Propensity to acquire modems

A tree analysis can also be used to develop scenarios for the adoption of networked computers, i.e. to identify the groups least and most likely to become digital connected.

To use online services, households currently need both a computer and a modem. Households with a computer and modem are not necessarily users of online services; for some households, this equipment may be used to remotely access work- or education-related databases. However, for the purposes of this analysis, the terms modem owner and online service user are used interchangeably. Almost half a million households already own both equipment items. Common sense suggests that the one and a half million or so households which currently use a computer at home, but which do not have a modem, are prime candidates for acquiring a modem.

In a similar analysis to that used to identify the households most likely to adopt computers, a tree analysis can be used to develop scenarios for the size and composition of the digital connected group in two years time.

Households most likely to acquire a modem were assumed to be those which currently have a computer, which plan to spend on computers or computer-related equipment within the next 12 months and which are interested in online services. This group consisted of around 365,000 households. Adding these to the households which already have a computer and modem as at February/May 1996 would give an aggregate penetration rate of 12.9%, with a socio-demographic breakdown as shown in table S3.7.

S3.7 MOST LIKELY MODEM PENETRATION IN HOUSEHOLDS, By 1998

	Households with PC and modem at Feb/May 1996		Households most likely to acquire a modem by 1998(a)	Most likely modem penetration(b)	
Household characteristics	'000	%	'000	'000	%
Household income quintile(c)					
Low	21	2.1	9	30	3.0
Lower middle	29	2.2	27	56	4.2
Middle	61	5.1	68	129	10.9
Upper middle	109	9.9	94	203	18.5
High	177	18.2	108	285	29.3
Household structure					
Couple without children	91	11.7	39	130	16.7
Couple with children	236	9.8	212	448	18.6
Single parent	21	3.6	23	44	7.5
Single person	41	5.7	36	77	10.8
Older person(s)	27	1.9	8	35	2.5
Group/extended family	69	9.9	46	115	16.5
Location of household					
Metropolitan	382	9.3	278	660	16.0
Non-metropolitan	103	4.1	87	190	7.6
Presence of home business					
Home business	137	14.2	109	246	25.5
No home business	348	6.2	256	604	10.7
Total	**486**	**7.4**	**365**	**851**	**12.9**

(a) The group of households most likely to acquire a modem by 1998 is that group with a PC, but no modem, at February/May 1996, which indicated an intention to spend on computers of computing equipment within 12 months and which were interested in on-line services. (b) The most likely modem penetration in households by February 1998 is formed by summing the group which had a modem at February/May 1996 and the group most likely to acquire a modem by 1998. (c) Does not add to 100% because excludes households not classified to a quintile (no income recorded); see St Clair et al (1996) for income ranges.

Source: BTCE estimates, based on unpublished ABS data.

This table suggests that the digital connected group is likely to continue to consist predominantly of higher income households, those with children, those in metropolitan areas, and those with a home business — in the short term at least. Older and low income households are noticeably under-represented, confirming the patterns observed for computers themselves.

However, tree analysis also suggests that there is another group, of similar size to the most likely group discussed above, which also might be considered likely to start using online services in the short term. This group consists of the 344,000 or so households which do not currently have a computer, but which are planning computer expenditures and which are interested in at least one online service (see Cells F and H in diagram S3.2). Given that many computers now have modems installed as standard equipment, the leap from telephone connected to digital connected is not unlikely for members of this group.

The final column in table S3.8 shows what the socio-demographic characteristics of the modem-owning population in 1998 would be if the adoption scenario shown in table S3.7 were to be augmented by addition of this next most likely group of households. In this scenario, aggregate penetration would be 18.1%, rising to more than 25% among upper middle and high income households and those with children.

S3.8 POSSIBLE MODEM PENETRATION IN HOUSEHOLDS, By 1998

	Most likely population of modem-owning households by 1998(a)		Next most likely population of modem-owning households by 1998(b)		Possible modem penetration(c)	
Household characteristics	'000	Share %	'000	Share %	'000(c)	%
Household income quintile(d)						
Low	30	4.3	21	7.0	51	5.1
Lower middle	56	8.0	60	19.7	116	8.7
Middle	129	18.3	62	20.6	191	16.1
Upper middle	203	28.9	81	27.0	284	26.0
High	285	40.5	78	25.7	363	37.3
Household structure						
Couple without children	130	15.3	46	13.5	176	22.7
Couple with children	448	52.6	155	44.9	603	25.1
Single parent	44	5.2	43	12.4	87	14.8
Single person	77	9.0	44	12.7	121	16.9
Older person(s)	35	4.1	11	3.1	46	3.2
Group/extended family	115	13.5	46	13.4	161	23.1
Location of household						
Metropolitan	659	77.4	245	71.1	904	22.0
Non-metropolitan	190	22.3	100	28.9	290	11.6
Presence of home business						
Home business	246	28.9	58	16.7	304	31.5
No home business	604	71.0	287	83.3	891	15.8
Total	851	100.0	344	100.0	1 195	18.1

(a) The group of households most likely to acquire a modem by 1998 is that group with a PC, but no modem, at February/May 1996, which indicated an intention to spend on computers or computing equipment within 12 months and which were interested in on-line services. (b) The next most likely group to acquire a modem by 1998 is those households with no computer or modem at February/May 1996 but which intended to spend on computers or computing equipment within 12 months and were interested in on-line services. (c) Column 1 plus column 3. (d) Does not add to 100% because excludes households not classified to a quintile (no income recorded); see St Clair et al (1996) for income ranges.

Source: BTCE estimates, based on unpublished ABS data.

The second and fourth columns in table S3.8 show how the households most likely and next most likely to adopt modems are distributed socio-demographically: it suggests that the next most likely group is quite similar in profile to the most likely group, albeit with a flatter income distribution, and a stronger representation of non-metropolitan households and households without home business.

Thus, if the next most likely group were to adopt modems, this would be consistent with diffusion of digital connectivity into the wider community. Once again, as with computers, this would be the result of faster rates of growth among later adopters, albeit from a lower base.

For example, table S3.9 shows that in 1994, metropolitan households were 4.1 times more likely to be digital connected than those in non-metropolitan areas. By 1996, this disparity was 2.2, and would fall to 2.1 under the more conservative most likely scenario, and to 1.9 if households which currently do not have computers, but which seem likely to acquire a bundled computer and modem, were to do so by 1998.

S3.9 GEOGRAPHIC DISPARITIES IN MODEM ADOPTION — 1994–1998

	Most likely modem penetration in households			Next most likely modem penetration in households
Household location	1994 %	1996 %	1998 %(a)	1998 %(b)
Metropolitan	5.4	9.3	16.0	22.0
Non-metropolitan	1.3	4.1	7.6	11.6
Ratio	4.1	2.2	2.1	1.9

(a) As derived in S3.7. (b) As derived in S3.8.

Source: BTCE estimates, based on unpublished ABS data.

Conclusion

The analysis presented here suggests that the proportion of households which will have computers could rise to around 40% by 1998. Penetration could rise to 60% in high income households and those with a home business. Higher levels would be achievable if lower prices were to make purchase more attractive for a group of around 10% of households who currently cite cost as their main reason for non-acquisition.

The proportion of households equipped to use online services could increase to levels around 13% within the next two years under the more conservative most likely scenario illustrated in table S3.7. Higher levels, about 18% in aggregate terms and as high as 37% in high income households, are conceivable if online services became sufficiently compelling for people to acquire a bundled computer and modem, as explored in the digital connected scenario illustrated in table S3.8.

Penetration rates higher than this would require households currently not using computers at home to acquire modems, or alternatively for the addition of households not presently planning any computer-related outlays in the next 12 months.

Under each of these scenarios, however, digital connectivity seems likely to remain very low among households with older persons, and to a lesser extent among single parent households. Households outside metropolitan centres look likely to continue to have a lower level of digital connectivity than their capital city counterparts, despite faster rates of growth in adoption.

Further research

The methodology outlined here offers a systematic means of examining the characteristics of households which are not only 'have nots' at present but which are currently the least likely to become 'haves' — even when prices fall.

However, there are several limitations to the approach used.

First, the analysis focused only on barriers related to the equipment needed in the home in order to access digital services via networks. The influence of differing telecommunications network capacity could not be considered in this framework. Offering respondents two different cost options as their reasons for not having a modem would assist in considering this issue, that is if they were able to distinguish between the capital costs of acquiring a modem and telephone access charges (which are higher for people who have to use STD calls to their Internet service provider, and for those whose network infrastructure is poor relative to that available in metropolitan areas).

Second, the 'why not' questions were presented to respondents in the form of a predefined list of 'main reasons', as identified through open-ended questioning in pilot surveys. While this approach facilitates large-scale data collection and analysis, there is always some risk that important factors might be missed. In this context, recent qualitative Belgian research which sought multiple reasons for non-adoption of a range of technologies is of interest: the results suggest that cost is a relatively minor reason for non-adoption of computers, and that instead responses broadly classifiable as 'no need for one' account for most non-adoption (Punie, 1996). However, the extent to which these findings might be applicable in an Australian context is unknown.

Third, the predictive power of the ABS survey questions on past and future market behaviour remains to be fully tested. The only question with a track record is the one which relates to intention to spend on computers and computing equipment within a year — and even here the predictions are accurate only when the time period between the stated intention to spend and actual expenditure is extended to two years. More work needs to be done in this area, not least in establishing whether there are significant differences in the accuracy of the predictions among groups with different socio-demographic characteristics.

Fourth, the results of the relatively simple multivariate analysis presented here does not disentangle significant correlations between, for example, income and geographic location. Other forms of analysis would be required to do this — a potentially fruitful area for future collaboration between the ABS and the BTCE.

These methodological issues aside, it is important to note that the analysis presented here cannot— and does not seek to — provide answers to key public policy questions like what should be done and why. The results do,

however, highlight gaps in our present understanding of the impact of online services. For example, it is clear that researchers currently have little information on which to assess the influence of digital technologies on the ability of individuals to participate in the economic and social life of their communities.

Thus, while the analysis presented here suggests that households consisting of low income and older people are concentrated in the group which is least likely to acquire a computer or a modem in the short term, what is still unclear is the extent to which this lack may translate into any constraint on the ability of such householders to participate in society and the economy.

What would help would be a way of linking ABS data on household adoption of digital technologies with other ABS data on labour market status, educational outcomes, and the information intensity of industries — in aggregate or, more usefully, at the local or regional level.

Analysis of such links could lay the foundations for improved assessments of the need for government intervention to influence the availability or takeup of digital technologies at the household level.

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