ACCESS ECONOMICS Pty Limited

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Australian Mobile Telecommunications Industry: Economic Significance & State of the Industry

Report by Access Economics Pty Limited for

Australian Mobile Telecommunications Association

PREFACE

This report was commissioned by the Australian Mobile Telecommunications Association (AMTA) and was completed by Access Economics.

AMTA is the peak industry body representing Australia's mobile telecommunications industry. AMTA's vision is to promote an environmentally, socially and economically responsible, successful and sustainable mobile telecommunications industry in Australia.

AMTA represents, acts, and communicates on behalf of industry to key stakeholders and decision makers: governments; regulatory authorities; consumer groups; and mobile users. AMTA's members include the mobile phone carriers, handset manufacturers, retail outlets, network equipment suppliers and associated businesses, as well as specialised consultancy services.

Access Economics is an economic consultancy that assists business and industry organisations analyse and participate in regulatory, taxation and public policy development, and advises governments and their oppositions in the development and costing of economic, regulatory and public policy. We also assist government and business planners forecast macroeconomic and demographic trends and analyse their implications for their specific operating environments, as well as measure the economic impacts and contributions of major investments and industry sectors.

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GLOSSARY

ABS	Australian Bureau of Statistics
ACMA	Australian Communications and Media Authority
ACCC	Australian Competition and Consumer Commission
ACLC	Annual Carrier Licence Charge
ADSL	Asymmetric Digital Subscriber Line
AE-GEM	Access Economics - General Equilibrium Model
AMPS	Advanced Mobile Phone Service
AMTA	Australian Mobile Telecommunications Association
ARPU	Average Revenue Per User
BSC	Base Station Controller
BSS	Base System Substation
BTS	Base Transceiver Station
CDMA	Code Division Multiple Access
CPI	Consumer Price Index
CSP	Carriage Service Provider
DCITA	Department of Communications, Information Technology and the Arts
DDSO	Digital Data Service Obligation
DWDM	Dense Wavelength Division Multiplexing
EVDO	Evolution Data Optimised
EU	European Union
FTE	Full-Time Equivalents
FTM	Fixed-to-Mobile
GDP	Gross Domestic Product
GE	General Equilibrium
GNP	Gross National Product
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HSDPA	High Speed Downlink Packet Access
HSPA	High Speed Packet Access
HSUPA	High Speed Uplink Packet Access
ICT	Information and Communication Technologies
IGP	Industry Gross Product
IMS	IP/Interactive Multimedia Subsystem
IP	Internet Protocol
IVM	Interactive Voice Messaging
IVR	Interactive Voice Response
kbps	kilobits per second
LAN	Local Area Network
LTE	Long Term Evolution
Mbps	Megabits per second
MCF	Mobile Carriers Forum
MHz	Megahertz
MIMO	Multiple-Input, Multiple-Output
MNP	Mobile Number Portability
MTAS	Mobile Terminating Access Service
MTSO	Mobile Telephone Switching Office
MVNO	Mobile Virtual Network Operator

MMS	Multimedia Message Service
MSC	Mobile Switching Centre
MTF	Mobile-to-Fixed
NFC	Near-Field Communications
NGN	Next Generation Networks
OECD	Organisation for Economic Co-operation and Development
OFCOM	Office of Communications (UK)
PSTN	Public Switched Telephone Network
PTT	Push-to-Talk
QoS	Quality of Service
RTT	Radio Transmission Technology
SIO	Services in Operation
SMS	Short Message Service
TDMA	Time Division Multiple Access
TFP	Total Factor Productivity
TIO	Telecommunications Industry Ombudsman
USO	Universal Service Obligation
VoIP	Voice over Internet Protocol
WAP	Wireless Application Protocol
WASP	Wireless Application Service Providers
W-CDMA	Wideband Code Division Multiple Access
WHO	World Health Organisation
WiMax	Worldwide Interoperability for Microwave Access
2G	Second Generation Technology
3G	Third Generation Technology
3GPP	Third Generation Partnership Project
4G	Fourth Generation Technology

EXECUTIVE SUMMARY

Access Economics was commissioned by the Australian Mobile Telecommunications Association (AMTA) to undertake research and prepare a report on the economic significance and contribution of the Australian mobile telecommunications industry.

The mobile telephone has experienced spectacular take up and growth worldwide over the past two decades and has significantly impacted upon businesses and the way people live. In Australia, the increase in mobile penetration has occurred in tandem with substantial declines in the price of mobile telephony.

On the technological side, with the introduction of third generation or "3G" mobile networks, there have been major advances in mobile handset technology, network capabilities as well as the number and variety of content services and applications. In addition to voice services, mobile networks now provide data and broadband services. In Australia, the first 3G network was launched in 2003. By the end of 2005 all carriers had operational 3G networks.

The key objective of this report is to measure and analyse the impacts of these developments in the telecommunications industry on the broader Australian economy and society.

INDUSTRY TRENDS AND GROWTH

The mobile telecommunications industry comprises the hardware sector, carriage service providers, retailers, as well as content providers, content aggregators and program developers.

The hardware sector is responsible for building and maintaining the network infrastructure required for telephony, as well as providing end-user hardware such as handsets. Carriage service providers (mobile network carriers and resellers) supply telecommunication services to the public using carrier network infrastructure.

The bulk of industry value added in the Australian mobile telecommunications industry is generated by mobile carriers, namely Telstra, Optus, Vodafone and Hutchison (through '3').

In 2005-06, mobile carriers generated revenues and value added of $12 billion and $5.6 billion respectively (see table below). In 2001-02, the corresponding figures were $8.3 billion and $4.4 billion

KEY STATISTICS OF MOBILE CARRIERS, 2001-02 TO 2005-06

	2001-02	2002-03	2003-04	2004-05	2005-06
Industry Revenue ($b)	8.33	9.06	9.84	11.24	12.03
Industry Gross Product ($b)	4.36	4.70	5.05	5.66	5.61
Number of Enterprises	22	25	24	20	17
Employment	18,828	19,267	20,067	21,468	20,950
Total Wages ($b)	1.09	1.15	1.23	1.36	1.36
Mobile Subscribers (m)	12.7	14.3	16.5	18.4	19.9

Source: IBISWorld, *Industry Report J7122: Mobile Telecommunications Carriers in Australia*, January 2007

The carriers employed nearly 21,000 workers and paid out wages totalling almost $1.4 billion in 2005-06, compared with 18,800 workers and $1.1 billion in wages in 2001-02. These carriers serviced nearly 20 million subscribers in 2005-06 versus under 13 million in 2001-02.

Revenue growth

In recent years revenues in mobile telecommunications have grown strongly at an average annualised rate of 5.8% between 2001-02 and 2006-07. This contrasts with the performance of fixed-line telecommunications, where revenues decreased by an average of 5.0% a year over the same period. The average growth rate in revenues generated by mobile telecommunications since 2000, however, is lower than that for the second half of the 1990s. In particular, annual revenue growth peaked at 30% in 1997-98 and declined to less than 10% by 2000-01.

Rise in mobile penetration

The increase in subscribers from fewer than 7 million in 1998-99 to 20 million in 2005-06 (of which more than 1.6 million were 3G subscriptions) has meant that the mobile penetration rate increased from just above 30% to almost 100% over this time period.

Mobile penetration rates differ considerably by age. While 90% of those aged between 25 and 34 owned or used in mobile phone in 2005-06, only 53% of those aged above 65 did so. Overall, 79.4% of all Australians aged 14 and above owned or used a mobile phone in 2005-06.

Preference for pre-paid

A recent trend in many mobile telecommunications markets around the world is the steadily rising number and proportion of pre-paid subscribers. In Australia, this proportion has increased from 27% in 2000-01 to 50% in 2005-06. The increase in pre-paid customers has been an important driver of recent subscriber growth. In 2000-01, there were 2.8 million pre-paid subscribers versus 7.4 million post-paid ones. By 2005-06, there were just over 9.7 million of each type of subscriber.

Messaging and data growth

There has been substantial growth in the use of mobile messaging services since the start of the new millennium. According to the Australian Communications and Media Authority (ACMA), the number of short message service (SMS) messages sent has increased from 1.9 billion in 2000-01 to 10.2 billion in 2005-06. The number of multimedia message services (MMS) transmitted increased from 13.7 million in 2003-04 to 63.6 million in 2005-06. This reflects an annual growth rate of 264% in 2004-05 and 28% in 2005-06.

Other non-voice services such as music, mobile TV, games and pure data traffic (including mobile portal browsing, PC Card connectivity, and specialised data traffic such as email using Research in Motion's BlackBerry) have also experienced rapid growth lately. Collectively, they represented almost 20% of non-voice services revenue (totalling approximately $1.45 billion or 16.7% of total service revenues) in 2005.

Handset shipments

Handset shipments into Australia rose rapidly between 2002 and 2004 (doubling from 4 to 8 million) but plateaued in 2005, before rising to 8.7 million in 2006.

Employment and wage growth

Between 2001-02 and 2005-06, employment by mobile network carriers increased from 18,800 to 21,000 while employment by mobile resellers decreased slightly from 6,600 to 6,500. Total wages paid to workers by mobile network carriers increased from $1.09 billion in 2001-02 to $1.36 billion in 2005-06. Total wages paid by mobile resellers rose from $290 million to $320 million over the same period.

Falling mobile telecommunications prices

Mobile subscriber growth and the rising mobile penetration rate in the last decade have been underpinned by significant decreases in the price of mobile telephony.

The recent fall in average mobile prices has been attributed in part to the growing popularity of “bucket” or “capped” plans. These plans provide mobile subscribers with a deeply discounted package of mobile services for a fixed price.

Between 1997-98 and 2001-02, the price of mobile telephony fell by approximately 27% (13.2% in 1999-2000 alone). While price decreases moderated between 2001-02 and 2003-04, prices decreased by 12.9% in 2004-05 and by 6.5% in 2005-06.

In 2005-06, the average cost per minute fell by 15.7% and 15.5% for pre-paid and post-paid services respectively. Average cost per minute fell by 12.9% for business subscribers.

INDUSTRY ENGAGEMENT WITH GOVERNMENT

Like all major industries, the mobile telecommunications industry engages with the Australian Government in various ways. The industry makes one-off and recurring payments to government and is subject to various government regulations.

Payments to government

Payments made by the mobile telecommunications industry to the Australian Government include one-off payments such as spectrum licences and ongoing payments such as annual spectrum access charges (encompassing the spectrum licence tax, universal service obligation and national relay service charges, numbering charges etc). Like businesses in other industries, those in the mobile telecommunications industry also pay corporate income taxes to the Australian Government and payroll taxes to State and Territory Governments.

Access Economics estimates that in 2005-06 the value of industry-specific payments to government was $176.1 million. This was equivalent to about 1.3% of total industry revenue.

Industry regulation

Key regulatory issues concerning mobile telecommunications services in Australia include Universal Service Obligation, the declaration of services, wholesale voice termination, mobile number portability, content services and law enforcement.

Looking ahead to potential future regulation in Australia, an examination of regulatory developments in Europe suggests that wholesale SMS termination and spectrum liberalisation may emerge as key issues in the coming years.

Key developments expected in European spectrum liberalisation for 2007 include major consultations by Ofcom and the European Commission on what to do with the spectrum released as part of the switchover to digital television between 2008 and 2012 (the "Digital Dividend").

PRODUCTIVITY, INNOVATION AND INVESTMENT

The mobile telecommunications industry is characterised by rapid technological and service innovations as well as costly, large-scale infrastructure (and other) investments. There has been increasing evidence in recent years about the link between these innovations and investments, on the one hand, and labour productivity, on the other.

Productivity

Mobiles have benefited businesses by facilitating faster communications between customers and colleagues, as well as closer and more effective management. They enable small slivers of time to be made productive and business to continue when people are on the move.

However, there has been a paucity of serious studies examining the contributions that mobiles have made to business productivity across the economy.

To address this knowledge gap, in December 2005, O_2 (now part of Telefonica) commissioned a report from the Centre for Economics and Business Research (CEBR). The report drew together research from a wide range of sources and an interview program of mobile users and mobile-using businesses to assess the overall contribution that the use of mobile made to labour productivity in the UK.

CEBR estimated that mobiles increase UK labour productivity by just under 1%. Because of mobiles, UK workers can all work for around 20 minutes less each week to achieve the same output. From another perspective, if all mobile workers were able to use 5% more of their time out of the office productively, this would be the equivalent of an extra 180 million hours of work each year. In total, CEBR estimated that the productivity benefits of mobile phones boosted UK GDP by £8.9 billion in 2004.

Industry innovation

The NGN is a broad term to describe several architectural evolutions currently underway in the telecommunication core and access networks. The general idea behind the NGN is that one network transports all information and services (voice, data, and multimedia) by encapsulating these into packets, as on the Internet. The two major components of any NGN are likely to be:

- an IP-based core network with enhancements to support not only Internet connectivity, but 'Quality of Service' (QoS)-based real-time services and applications; and
- broadband customer access network with support for both and mobile services.

The resulting simplified network structure, allows NGNs to deliver convergence between the traditional fixed and mobile telephony networks and the new Internet networks, by carrying a

full range of services, such as real-time voice and multimedia services on a common broadband digital connection to consumers. As NGNs are 'agnostic' in terms of access, they also have implications for fixed-to-mobile convergence.

For mobile-only operators the benefits of an NGN include lower transmission costs and, more significantly, the ability to offer richer multimedia services. Examples of the types of NGN services that can be offered are presence and buddy lists, content sharing, and multimedia communications, which will eventually be able to interoperate across all mobile networks in much the same way as SMS does today.

Industry and government investment

The mobile telecommunications industry is a capital-intensive one due to rapid technological advances and the requirements for building an extensive nationwide network infrastructure.

The first 3G network in Australia was launched by Hutchison in mid-April 2003 under the '3' brand. To defray the massive costs associated with building new 3G mobile networks, both Hutchison and Telstra, and Vodafone and Optus announced they were entering into 3G network sharing arrangements in August 2004 using the 2100 Megahertz (MHz) spectrum band. Both networks primarily covered major metropolitan and urban areas that constituted about 55% of the population.

In October 2006, Telstra launched a new national 3G network using the lower 850MHz spectrum band. The network currently covers 98.8% of the Australian population. In January 2007, Optus also announced that it would invest up to $800 million to extend its 3G mobile communications network to 96% of the Australian population.

All carriers have also recently enabled, or are in the process of enabling, their 3G networks with the High Speed Downlink Packet Access (HSDPA) standard. Today with an HSDPA-enabled device (a mobile phone or a data card), Australian consumers can experience speeds of between 600 kilobits per second (kbps) and 1.5 Megabits per second (Mbps) with a theoretical maximum speed of 3.6 Mbps. Longer term upgraded networks will in theory support downlink speeds of up to 14.4 Mbps and provide carriers with an upgrade path to offer enhanced data services in the future. For consumers, HSDPA will mean shorter service response times, fewer waits and faster connections, and an increased offering of interactive services and applications.

In August 2005 the Australian Government announced the $1.1 billion *Connect Australia* package, then the single largest investment in telecommunications services in the country, to improve broadband speeds and rollout, deliver better mobile phone coverage and help connect schools, hospitals and universities to the communications services they need.

On 18 June 2007, the Australian Government announced a funding and legislative initiative — *Australia Connected* — that aims to ensure that 99% of the population has access to fast affordable broadband by June 2009. $958 million of funding was granted to the Optus and Elders joint venture, OPEL Networks Pty Ltd (OPEL), which as part of the deployment to deliver broadband services to regional and remote areas, is installing 1361 broadband wireless sites using WiMax (i.e. Worldwide Interoperability for Microwave Access) technology.

ECONOMIC IMPACT OF THE INDUSTRY

The mobile telecommunications industry makes a substantial contribution to the overall Australian economy. In addition to its direct contribution to aggregate output through value added by the industry, mobile telecommunications also benefits other industries and economic sectors by raising the labour productivity of workers.

Access Economics has used its in house dynamic computable general equilibrium model, AE-GEM, to quantify the economy-wide impacts of falling mobile telecommunication prices and rising labour productivity resulting from increasing mobile penetration.

The modelling exercise draws upon some of the key insights revealed and explored in the preceding chapters of this report. These insights include:

- declining mobile telecommunication prices benefiting consumers of mobile products and services and users of fixed-line services through competitive pressures from fixed-to-mobile (FTM) substitution;
- increases in business productivity arising from the use of mobile phones (particularly among mobile workers); and
- increasing use of messaging services (SMS and MMS) and other forms of mobile data services due to the introduction, implementation and customer adoption of high-speed 3G network and new handset technologies.

Direct contribution

The direct contribution an industry makes to the overall economy can be measured by industry value added or Industry Gross Product (IGP). Between 2001-02 and 2005-06, the combined industry value added of mobile network carriers and resellers increased from $4.5 billion to $5.8 billion while its share of value added in the whole communications industry rose from 22.2% to 24.9%. IBISWorld analysis suggests that the mobile telecommunications industry will account for 37% of total telecommunications sector value added in 2006-07.

Indirect contribution

Mobile telecommunications also impact the broader economy indirectly through its linkages with upstream and downstream industries as well as the labour productivity gains it enables.

With mobile penetration reaching higher levels, capped pricing plans and a large volume of mobile-to-mobile calls, consumers appear to increasingly perceive the mobile service as a substitute for traditional fixed-line voice services. This FTM substitution places competitive pressures on fixed-lined suppliers, which arguably leads to lower prices of telecommunications services and increases the level of allocative efficiency in the economy.

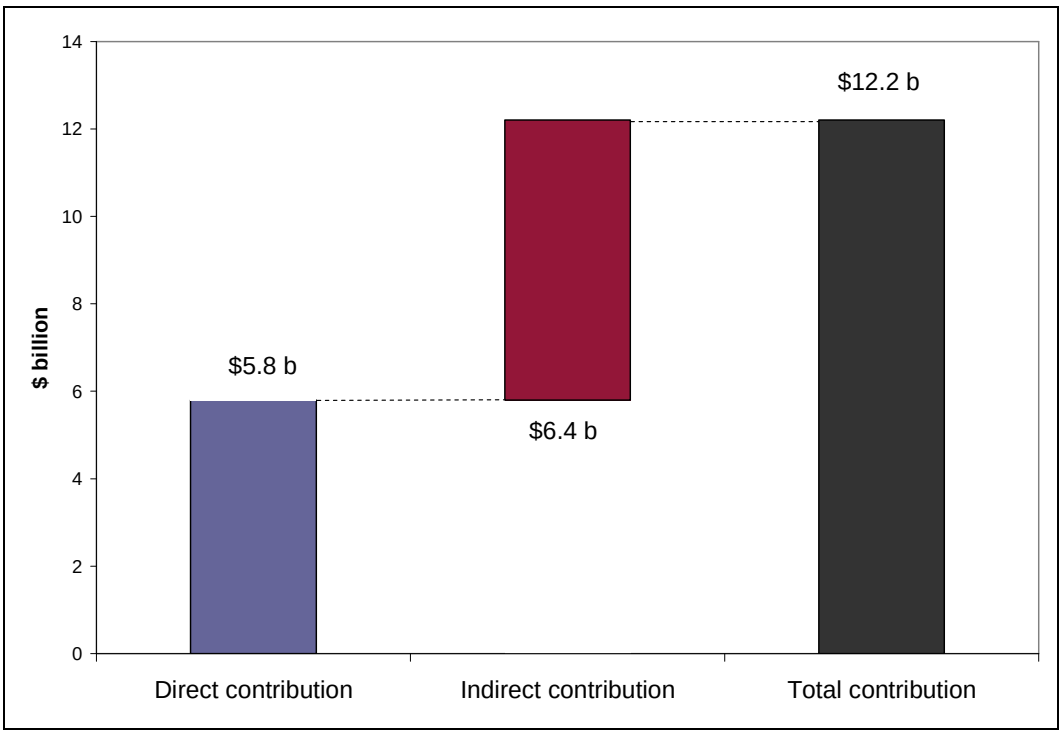
In addition to the economic benefits the mobile industry confers within the telecommunications sector, the mobile industry is also likely to provide benefits through mobile devices being an input that increase productivity in other sectors of the economy. For example, in a progressively more mobile work environment, Personal Digital Assistants (PDAs), smartphones and mobile broadband devices allow people to remain up-to-date with news and developments on projects in the work place whilst out of the office.

Economy-wide modelling undertaken by Access Economics estimated that, in 2006, the mobile telecommunications sector:

- increased Australian real Gross Domestic Product (GDP) by $6.4 billion with associated positive impacts on investment (up by $3.7 billion) and household consumption (up by $3.0 billion);
- increased Australian welfare, measured by real Gross National Product (GNP), by $6.0 billion;
- increased employment by 53,000 Full-Time Equivalents (FTEs); and
- lowered pressure on Australia's Consumer Price Index (CPI) while at the same time raising real wage rates.

In addition, the increasing uptake of 3G technology and the consequent increase in mobile data traffic are expected to add another $1 billion to GDP by 2010 (above and beyond the gains from mobile voice).

ECONOMIC CONTRIBUTIONS OF MOBILE TELECOMMUNICATIONS, 2006



Source: Access Economics

It is interesting to note that the broader impacts on GDP are even larger than the direct value added by the industry (as measured by the combined industry gross product or IGP of mobile telecommunications carriers and resellers, which was $5.8 billion in 2005-06 — see chart above).

POLICY IMPLICATIONS AND CONCLUSIONS

The preceding chapters have shown that the mobile telecommunications industry contributes substantially to the Australian economy. In addition to its direct contributions, it drives productivity gains throughout the economy. This characteristic of the mobile telecommunications industry contrasts with other key sectors such as mining, which makes a significant direct contribution to the economy but much smaller indirect contributions.

Productivity growth surged in Australia in the 1990s as a result of extensive microeconomic reforms adopted by the Australian Government that enhanced competition and increased openness to trade, as well as the rapid adoption of new information and communication technologies (ICT) by businesses. These two developments were symbiotic and mutually reinforcing.

After the stellar performance of the 1990s, productivity growth appears to have stalled in Australia since. Australia continues to lag behind the US in overall productivity and in the productivity of many individual industries.

Innovation in mobile telecommunications in the past few years have focused on the convergence of communication, media and information technologies in order to facilitate wider and more integrated methods for information distribution. This convergence means that governments should have a consistent and integrated set of policies and regulations that will not inhibit, but rather facilitate, rapid uptake of emerging ICTs by households and businesses. Where possible, such policies could be developed through a cooperative approach and engagement with industry. Only then can mobile telecommunications continue to foster productivity gains across Australian industries and assist in closing the productivity gap between Australia and leading edge countries like the US.

Access Economics
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1. INTRODUCTION

The mobile telephone has experienced large take-up and growth worldwide over the past two decades and has significantly impacted upon businesses and the way people live. Starting from a zero base in the 1980s, mobile penetration in many developed countries is either close to reaching, or has reached, levels of natural saturation — that is, when statistically every person in the population from age 12 onwards is a subscriber to a mobile service. In Australia, this increase in penetration has occurred in tandem with substantial declines in the price of mobile telephony.

On the technological side, there have been major advances in mobile handset technology (for example, built-in cameras and large, high resolution full-colour screens), network capabilities (such multi-media services and wireless broadband services), as well as the number and variety of content services and applications (ring tones, gaming services, music, etc).

It is against this background that Access Economics was commissioned by the Australian Mobile Telecommunications Association (AMTA) to undertake research and prepare a report on the economic significance and contribution of the Australian mobile telecommunications industry. This follows three preceding reports published annually between 2003 and 2005.

1.1 STUDY OBJECTIVES

The key objective of this report, then, is to measure and analyse the impacts of the above developments in the telecommunications industry on the broader Australian economy and society. This is achieved by:

- detailing information on the industry participants and industry growth;
- highlighting the continuous innovation in products and services that has underpinned recent industry growth; and
- undertaking sophisticated general equilibrium modelling of the macroeconomic impacts of falling mobile prices, rising penetration rates, as well as labour productivity gains arising from the use of mobile voice and data.

It is hoped that this report will be a valuable tool for the industry to promote increased public awareness of the economic and social importance of Australia's mobile telecommunications industry and the factors likely to shape its future.

1.2 STUDY APPROACH

The project was conducted from February to July 2007. It involved:

- desktop research to collect relevant national and international information on the mobile telecommunications industry;
- designing the economic modelling scenarios, verifying the model data inputs, adapting and customising Access Economics' in-house computable general equilibrium model, AE-GEM, and running the modelling simulations; and
- collation, analysis and presentation of the data and modelling results.

AMTA and Access Economics welcome comments on the methodology used and material presented in this report.

1.3 REPORT STRUCTURE

This report is organised as follows: the next chapter provides a snapshot of the Australian mobile telecommunications industry, including a brief history of mobile network technology, services currently offered by the industry, as well as an overview of the industry's structure. Chapter 3 charts the growth of the industry in recent years in terms of revenues, subscribers, volume of messages and handset sales. It also discusses the decline in mobile prices and the substitutability and complementarity between mobile and fixed-line networks.

Chapter 4 describes the interactions between the mobile telecommunications industry and the Australian Government, such as industry regulation and the industry's various payments to Government. Chapter 5 examines the link between mobile telecommunications and business productivity, and discusses recent industry innovations and investments. Chapter 6 describes the direct and indirect economic contributions of the industry, and presents results from Access Economics' general equilibrium modelling exercise that draws upon key insights from the preceding chapters. Finally, Chapter 7 discusses the policy implications and conclusions of the report

2. THE MOBILE TELECOMMUNICATIONS INDUSTRY

This chapter provides an overview of the mobile telecommunications industry. Topics covered include a brief history of mobile telecommunication technology, services currently offered by the industry, as well as the structure and major sectors of the industry.

2.1 A BRIEF HISTORY AND CURRENT DEVELOPMENTS

Today's widespread use of mobile phones was made possible by the introduction of hexagonal cells for mobile phone base stations, invented in 1947 by engineers at AT&T and was further developed by Bell Labs during the 1960s.

2.1.1 1G: ANALOGUE TECHNOLOGY

Cellular telephone technology introduced the concept of spectrum re-use within a given geographical area. Prior to the introduction of the mobile phone, car telephones made exclusive use of a given frequency band in a geographic area, greatly limiting the number of users.

Martin Cooper of Motorola is widely considered to be the inventor of the first practical mobile phone for handheld use in a non-vehicle setting. Using a modern, if somewhat heavy portable handset, Cooper made the first call on a handheld mobile phone on 3 April 1973.

Cellular technology allowed for frequency re-use by using a hexagonal network of cells. Each base station covered one cell. When a user went from one cell to an adjacent cell, the user would be handed off seamlessly to the new base station. Thus, non-adjacent cells would be using the same frequencies to serve mobile phone users. (Adjacent cells are not used because of potential interference problems.) Capacity could be increased by a factor of eight by cell splitting and sectorisation (where, for example, three antennae, each transmitting over a 120-degree angle, replace a single antenna transmitting over the full 360 degrees).

Fully automatic cellular networks (1G) were first introduced in the early to mid-1980s. The technology used different frequency carriers to create communications channels via Frequency Division Multiple Access (FDMA) and only had voice functionality. The first fully automatic mobile phone system was the 1981 Nordic Mobile Telephone (NMT) system. In Australia, the first mobile phone system began operation in August 1981 in Melbourne.

1987 saw the launch of the first Advanced Mobile Phone Service (AMPS) cellular network in Australia. Bulky and heavy handsets retailed at over $4,000 at the time. The number of mobile network operators increased in the next five years along with the rising number of subscribers. The government mandated the closure of the analogue network in 2000 due to its inefficient use of spectrum.

2.1.2 2G: DIGITAL VOICE TECHNOLOGY

Notwithstanding the rise of 3G, the second generation of mobile technology continues to play a significant part in the Australian mobile market, accounting for a vast proportion of total industry product segmentation in 2005-06. Offering limited data functionality, 2G services are provided on two networks: Global System for Mobiles (GSM) and Code Division Multiple Access (CDMA).

Structure of Mobile Networks

Mobile networks are composed of the following equipment and software:

The base transceiver station (BTS) or base station subsystem (BSS) – The base transceiver station is connected to the antenna, and transmits and receives mobile calls from the site's antenna and amplifies signals. A base station consists of a BTS plus the antenna. The base stations are the costliest parts of a mobile network's hardware.

The base station controller (BSC) – The BSC is the 'traffic cop' of the mobile network. It does pre-call setup (that is, it assigns calls to radio channels in the BTS, sends ringing to the correct channel and measures signal strength). The BSC can be located at the BTS or one controller can manage many BTSs.

The mobile switching centre (MSC) – also called the mobile telephone switching office (MTSO). The MSC switches calls between mobile networks and the public switched telephone network. Mobile switches have Signalling System 7 (SS7) links to databases that contain billing and roaming information. New mobile switches may control up to 1024 cell sites.

Databases – Home location registers (HLRs) contain information service and billing information on subscribers. The HLR also keeps track of the status and location of subscribers within its area.

Connections to the public switched telephone network (PSTN) – Mobile telephone switching offices are connected to landline public networks by high-speed T-3 links.

Source: A.Z. Dodd, *The Essential Guide to Telecommunications 3rd Edition*, Prentice Hall, 2002

Initially originating in Europe, GSM is a Time Division Multiple Access (TDMA)-based second-generation mobile cellular radio technology that supports voice, data and text messaging and allows roaming between different networks. First introduced into the Australian market in 1993, Telstra, Optus and Vodafone presently operate 2G GSM networks using 900 Megahertz (MHz) and 1800 MHz spectrum.

CDMA technology is a wireless communications technology that utilises the principle of spread spectrum communication. Under CDMA, communications channels are created by assigning a special coding scheme to information flows. CDMA services were introduced to Australia in August 1999 and are expected to be phased out in early 2008.

Carriers in Australia have also incorporated the General Packet Radio Service (GPRS) data standard into their GSM networks and the 1xRTT (single carrier Radio Transmission Technology) data standard into their CDMA networks ('2.5G networks'). 2.5G technology refers to the increased functionality of 2G and is regarded as a stepping stone from 2G to 3G in that it offers enhanced data services such as Wireless Application Protocol (WAP) and Multimedia Message Service (MMS). WAP offers mobile-Internet connectivity at relatively low speeds. Bandwidth limitations and limited web content for handheld display has hindered both the implementation and take-up of WAP in Australia and overseas.

Connectivity Enabled by 3G

3G enables schools that have multiple campuses to engage with other schools via live video streams, which means students are not confined to classrooms while learning. Caulfield Grammar utilises this technology. Students in Melbourne link with the Nanjing Campus on the other side of the world to allow users to explore the streets of Nanjing, make virtual visits to local shops and market stalls, while also enabling staff and students in Nanjing to communicate with the broader Caulfield Grammar community.

Source: AMTA, *Third Generation Mobile Networks in Australia — Broadband for your Mobile Phone*, An Information Booklet, 2005

2.1.3 3G AND BEYOND

3G: Expanded functionality

3G technology was first offered in Australia by Hutchison's 3 in 2003, using Wideband Code Division Multiple Access (W-CDMA) technology. 3G technology offers services such as music and video downloads, mobile broadband, improved Internet connectivity and a host of other data-rich services.

3G networks are now being offered by all mobile network carriers in Australia. Initial 3G network implementations used the 2100 MHz spectrum band, primarily in urban areas. For example, Hutchison's 3 and Telstra jointly operate a 3G network in the 2100 MHz band, covering metropolitan areas that form 56% of Australia's population, while Vodafone and Optus jointly built and operate a 2100 MHz 3G network to 55% of the population.

Telstra introduced its 'Next G' 3G network in October 2006 using the lower 850 MHz spectrum. The network claims to cover 98.8% of the population. In January 2007, Optus has announced that it will invest $800 million to extend its 3G network to 96% of the Australian population.

Related technological developments

3G mobile network technology has been combined with other innovations. An example is Bluetooth, which allows rapid data transfer from mobile devices to Local Area Networks (LANs) and PCs over short distances. Mobile users are thus able to conveniently upload and download large amounts of data automatically, without having to use the mobile network to do so.

Another interesting technological development is Worldwide Interoperability for Microwave Access or WiMax. WiMax aims to provide wireless data over long distances, in a variety of different ways, from point to point links to full mobile cellular-type access.

Some mobile phone companies are evaluating WiMax as a means of increasing bandwidth for data-intensive applications. In the US, Sprint Nextel announced in mid-2006 that it would invest about US$ 3 billion in a WiMax technology build-out over the next few years.

In line with these possible applications is the technology's ability to serve as a high bandwidth "backhaul" for Internet or mobile phone traffic from remote areas back to an Internet backbone. Given the limited wired infrastructure in some developing countries, the costs to install a WiMax station in conjunction with an existing cellular tower or even as a

solitary hub are likely to be small in comparison to a fixed-line solution. Rural and regional areas with low population density and flat terrain are well suited to WiMax and its range. In Australia, WiMax (or pre-WiMax) networks are available[1] in the major capital cities and one regional centre. For countries that have skipped wired infrastructure as a result of prohibitive costs and unsympathetic geography, WiMax can offer an alternative access solution.

As part of the Australian Government's *Australia Connected* legislative and funding package, the Optus and Elders joint venture OPEL will deploy wireless broadband using WiMax technologies to deliver broadband services to rural and regional Australia.

'3.5G': Speed Enhancements to 3G

The term '3.5G' refers to enhanced 3G services, typically to High Speed Downlink Packet Access (HSDPA), an advancement on W-CDMA that supports 'bursty traffic' and in theory offers downlink speeds of up to 14.4 Megabits per second (Mbps). Most commercial deployments currently support data download speeds up to 3.6 Mbps, compared with the 384 (kilobits per second) kbps typical of original Evolutionary Data Optimised (EVDO)-based 3G network offerings.

HSDPA is part of HSPA, a set of standardised technologies that defines the migration and upgrade path for mobile operators worldwide. In addition to HSDPA, HSPA includes HSUPA (High Speed Uplink Packet Access) and HSPA Evolved. HSUPA will augment HSDPA to create a more symmetrical high performance system by providing peak uplink rates of 5.7 Mbps. These technologies enable more efficient use of spectrum and increase total throughput capacity of a network, and have the advantage of being backwardly compatible with existing 3G networks.[2]

Unlike many other mobile broadband technologies, HSDPA provides efficient voice services in combination with mobile broadband data, enabling mobile network carriers to continue to operate their traditional voice business models whilst at the same time facilitating increased uptake of high-speed data services. Nortel has shown that HSDPA has enabled a 37% reduction in operating expenditures due to the lower cost per megabyte of data transmitted.[3]

For consumers, HSDPA translates into shorter service response times, fewer waits and faster connections. Wireless users can talk on the phone while simultaneously downloading packet data.[4] In addition to allowing users to download Web pages, audio and video, the increased speeds and lower latencies enabled by HSDPA make interactive applications like multi-player gaming viable.

HSDPA services were first deployed in 2005 by AT&T (formerly Cingular) in the United States and Manx Telecom in the UK. Around the world, 168 network operators have committed to deploy HSDPA in 78 countries, with 115 HSDPA networks already launched in 58 countries. In the first quarter of 2007, over 63% of subscription growth in Western Europe

[1] For example, Unwired has coverage in parts of Melbourne and Sydney. Personal Broadband Australia (PBA) has coverage in parts of Melbourne, Sydney, Brisbane and the Gold Coast, Canberra, Adelaide and is commencing service in Perth. Austar has an initial service in Wagga Wagga. All these current services use "pre-WiMax" proprietary systems, with announced plans to upgrade to standards-based WiMax.

[2] GSM Association, *How to Realise the Benefits of Mobile Broadband Today*, February 2007.

[3] Nortel, *HSDPA and Beyond*, White Paper, 2005.

[4] "HSDPA — The Next Step for 3G", December 2004, www.3gnewsroom.com/3g_news/dec_04/news_5314.shtml

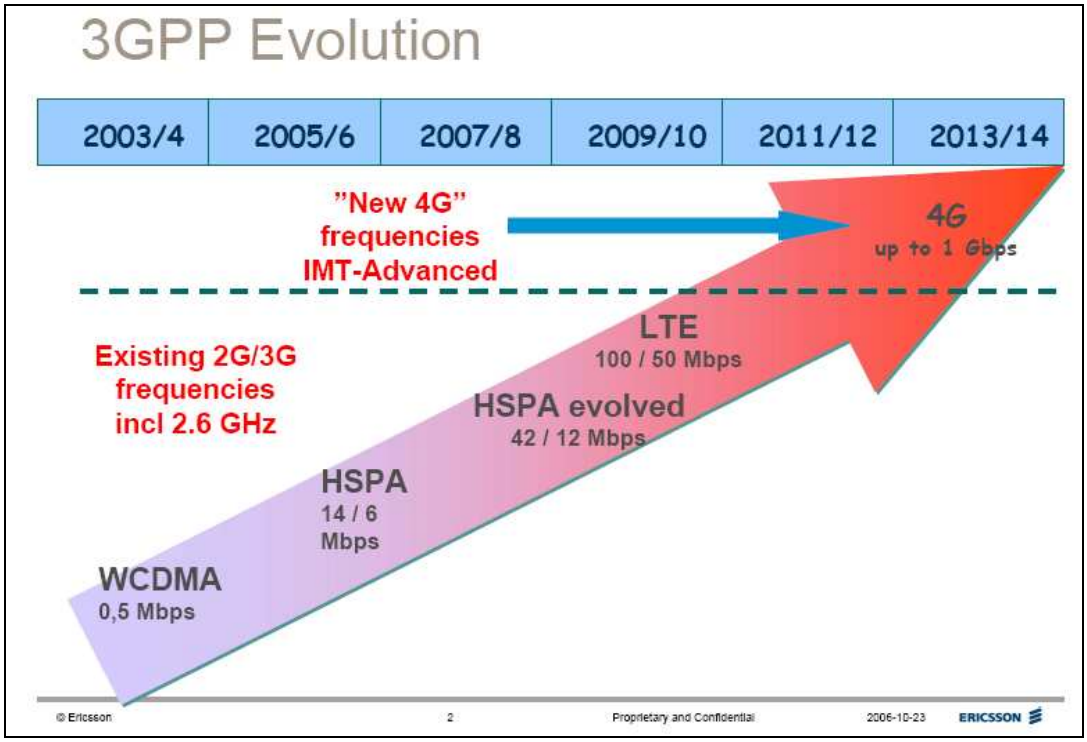
was for WCDMA-HSDPA service. In Australia, all network operators have deployed or are in the process of deploying HSDPA in their 3G networks.

HSPA Evolved introduces MIMO (Multiple-Input, Multiple-Output) capabilities and higher order modulation. HSPA Evolved is capable of delivering 42 Mbps peak bit rate in the downlink and above 11 Mbps peak bit rate in the uplink. It enhances the capacity for non-real time traffic such as email and the Internet as well as real-time services such as Quality of Service (QoS)-based Voice over Internet Protocol (VoIP).

Long Term Evolution (LTE) incorporates advanced technology that provides exceptional spectral efficiencies and end user data rates exceeding 100 Mbps coupled with very good capacity and latency figures. LTE will support channel bandwidths from 1.25 MHz to 20 MHz.

The evolution path for mobile network technology is illustrated in Figure 2-1.

FIGURE 2-1: EVOLUTION PATH OF MOBILE NETWORK TECHNOLOGY



Source: Ericsson

Note: 3GPP stands for "Third Generation Partnership Project", which is a collaboration between several standards bodies around the world

'4G': Ultra-Fast Technology for the Future

It has been suggested that so-called 4G technology will support transmission speeds up to 1 Gbps when users are on the move. Such speeds will realise total convergence of devices such that on-demand media will be able to be played and viewed on a handheld device, mobile (such as a smartphone) or laptop using a 4G data card.

According to IBISWorld, Japan's NTT DoCoMo (which initially developed W-CDMA) is a major proponent of 4G technology with aims of introducing the service in Japan at or around 2010. In December 2005, NTT successfully conducted an outdoor trial where downlink transmission speeds reached 2.5 Gbps

Possibilities Offered by 3G Technology

3G represents a quantum leap in mobile technology over 2G. Its capabilities have been likened to what broadband is to the computer industry — both offer dramatically increased speed and major changes in what people can do with the technology.

3G operates in a different way to 2G digital mobile networks. When a call is made on 2G a slot or line is held open for the users' conversation during the call. On 3G networks, the data is parcelled up into small packets which are re-assembled in the correct order at the receiving end. This smart encoding means that more data can be sent more efficiently.

The convergence of the Internet with mobile communications technologies has introduced new ways of delivering content and applications for the end-user. Convergence is the process whereby communication technologies blend to facilitate distribution of information. The three critical and inter-related technological innovations are:

- improved speed of data networks that supports the efficient delivery of large data files;
- increased capability of devices beyond supporting voice, SMS and MMS to send and receiving music, sound, video and other information; and
- availability of information that can be integrated by, for example, linking visual data with geographic reference points.

The information, communication and entertainment services that are available anywhere, anytime include:

- **Video calling** – video calling enables customers to see and hear one another when making a call.
- **Picture and video messaging** - pictures can be sent to friends, family and colleagues direct to camera phones, email or the web.
- **Full-track music download** – customers can download full-track music downloads to their handset and listen to near-CD quality music.
- **Games** – customers have better graphics, sound and depth of content due to the greater bandwidth of 3G
- **Mobile TV** – in addition to live TV, customers can catch up on their favourite television programs by downloading or streaming video clips straight to their handsets. Mobisodes are made-for-mobile TV and film content that are available on demand.
- **News and sport** – customers can be informed of breaking news and sporting events, or watch video highlights of sports such as cricket; they may be alerted as to when a wicket has fallen and offered the opportunity to watch a video reply or presented with ball-by-ball scores and match statistics.
- **Local guides** – customers can access information guides on restaurants, bars, transport, movies, TV programming etc.
- **Mobile business management** – provides the capability for small and medium-sized businesses to manage sales force calls, inventory and email.

Source: AMTA, *3G: The Next Generation of the Mobile Phone Revolution*, Industry Fact Sheet

2.2 MOBILE TELECOMMUNICATIONS IN AUSTRALIA TODAY

Mobile telecommunications is available to a vast majority of Australians, who are able to access a broad array of services. As new technology has enabled increasing consumer choice of services and applications, dependence on the mobile has increased significantly.

According to research by Ericsson Australia, between 2004 and 2006, the proportion of end-users who believe it is “important to me to be always contactable wherever I am” increased from 55% to 60% while the proportion who believe it is "important to be able to access the Internet wherever I am" increased from 27% to 41% (and to 48% for 18-34 year olds).

2.2.1 SERVICES OFFERED

A wide variety of mobile telecommunication services is currently available to both personal and business users in Australia. In addition to voice services (both conventional and push-to-talk), there are data services such as SMS and MMS as well as other services such as mobile broadband, mobile TV and m-commerce.

Wireless Network Communication Services (Voice)

Wireless communications services use radio waves, sent over air waves (spectrum) from one antenna to another, as the medium for communication. Wireless networks continue to play an increasingly important role in the general telecommunications industry as voice telephony appears to be moving away from existing fixed networks to mobile networks. According to ACMA, the number of Australian mobile subscribers exceeded the number of fixed-lines in 2000-01.[5] In June 2006, there were an estimated 19.76 million mobile subscribers compared with 11.26 million fixed-lines.[6]

Voice remains the primary use of mobile devices. However, this service has been commoditised, reflected in declining average revenue per user (ARPU) across almost all major market segments. Carriers are aware that competition within this service segment will intensify and margins will decline, which explains their increasing focus on data services.

SMS and MMS Text Communication Services (Data)

Short Message Service (SMS) enables mobile phones to send and receive text messages. Having enjoyed large growth in recent years, the Australian networks carried over 10.2 billion messages in 2005-06 (up from 1.8 billion in 2000-01).

Recently Australian businesses have begun using SMS technology to improve customer service and reduce costs. For example, Connex Melbourne uses SMS to inform customers if trains have been delayed or cancelled while Coca Cola has introduced a system that link its contact centre with its field workers.

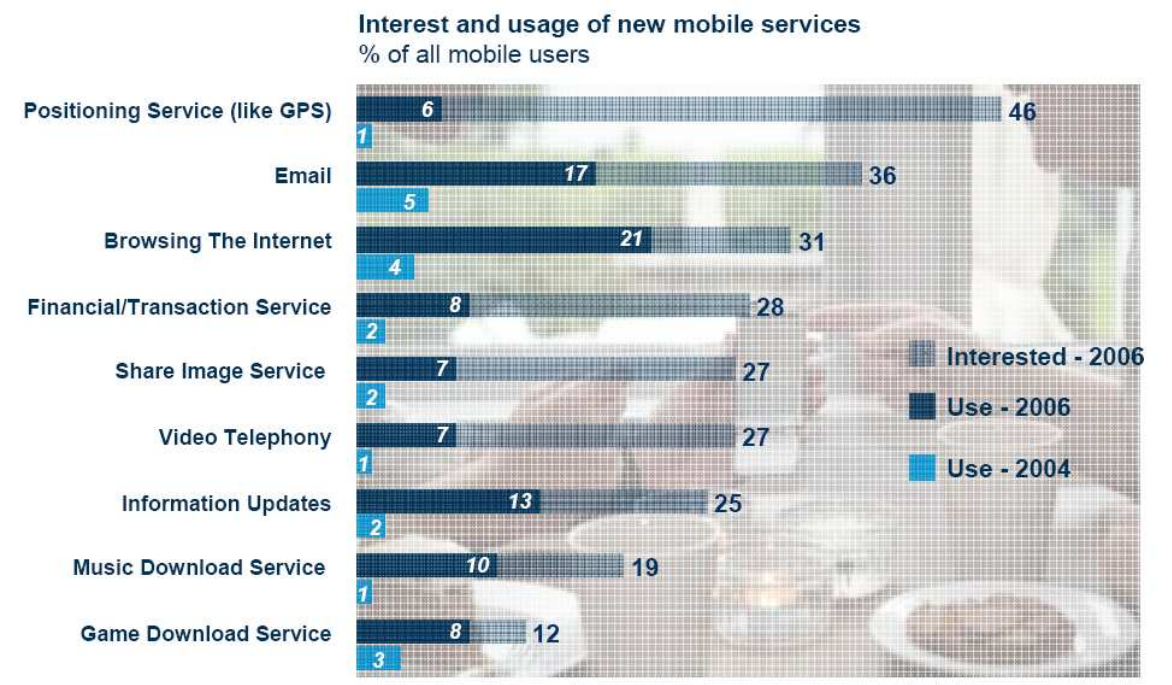
As its name implies, multimedia message service (MMS) enables sound and images to be sent and received in addition to text. In 2005-06 approximately 63.6 million MMS were sent in total, compared to 13.7 million in 2003-04. This growth has been facilitated by the ubiquity of phones with attached cameras of increasing resolution and quality.

[5] ACMA, *Telecommunications Performance Report 2004-05*, November 2005.

[6] ACMA, *Telecommunications Performance Report 2005-06*, October 2006.

Consumer Interest in Mobile Services

Australia ranks ahead of the UK and the USA in terms of interest in new mobile services, according to consumer research by Ericsson. The services Australians identified as the top three most interesting were positioning services, like GPS, followed by email and browsing the Internet. However, In terms of actual usage, 21% of respondents ranked browsing the Internet ahead of other services, such as using email (17%), information updates (13%) and music download services (10%).



Source: Ericsson ConsumerLab (Australia), 2006

Mobile Broadband

Mobile broadband services have already been launched by 145 operators in 68 countries/territories, covering more than one billion people worldwide. To date, more than 475 devices have been launched or announced for these services. These devices include feature phones, smartphones, PDA's, PC Cards and Express Cards, USB 'thumb' drives, embedded notebooks and even desktop modems.

Mobile broadband technologies include those that deliver typical end-user downlink data rates of 500 kbps or more while providing full mobility. Mobile broadband rivals the experience of wired broadband technologies, such as Asymmetric Digital Subscriber Line (ADSL). It enables suitable user experiences for a broad range of data applications — including email with attachments, web browsing, multimedia streaming and file downloads — while stationary or on the go. This end user experience baseline has also become important for PC notebook manufacturers who decided to embed mobile data into their products only once it could deliver a broadband experience.

Push-to-Talk (PTT) (Voice)

Push to Talk has been available for over two years and offers consumers the ability to talk to another individual or group without having to make additional calls. Functioning like a two-way radio or 'walkie-talkie', slight lags are still apparent after a user presses a button. Penetration has remained very low.

Mobile TV (Data)

Mobile TV is expected to be one of the value added services that will drive margins and 3G penetration for carriers. Popular forms of mobile TV are expected to be news clips, sport highlights, music video clips and 'mobisodes' (shows specially made for mobile handsets). In addition, connectivity to blogs and popular sites such as MySpace and YouTube may represent an opportunity for mobile carriers and content providers.

Mobile Electronic Payments

In July 2006, Nokia and a smartcard supplier announced that local trials of mobile phones being used as credit cards had commenced. To utilise this function, mobile phones must be supplied with a near-field communications chip (NFC) and an antenna to pick up a radio frequency. Not unlike the use of electronic tags for road tolls, the mobile phone is simply held up to a point-of-sale (POS) machine.

In the US, mobile service providers now see mobile payments as a way to increase customer loyalty while payment companies such as Visa view phones as the key to winning over American consumers, who use cash and checks for 46 per cent of their spending.

"I think the mobile device is simply the most promising new form of payment system available today," Visa chief executive John Philip Coghlan was quoted as saying recently.

About 57 per cent of US consumers are interested in using mobile phones for purchases and 64 per cent would consider leaving a wireless service provider that did not offer mobile payments, Coghlan said, citing a Visa survey of 800 people in mid-March.

Source: "Visa Talks Up Mobile Payments", The Australian, Sinead Carew, 29 March 2007.

Mobile TV is aimed at the core 3G demographic, which are so-called "Generation Y" and "Generation X" users, who are typically early adopters of new technology. However, it faces competition from outside the industry (such as Apple with its video-enabled iPod) as streaming data and voice on the same range of frequencies represents an inefficient use of spectrum.

The prospect of mobile TV becoming more popular has been raised by faster data transmission rates afforded by enhanced 3G technology.

Mobile Commerce (m-Commerce)

Mobile commerce is another service that can provide an additional revenue streams and boost margins for carriers as voice margins decline. The history of m-commerce in Australia can be traced back to 1999 when the Commonwealth Bank of Australia and Vodafone launched MobileBank, which enabled banking customers to check account balances, transfer funds and pay bills using their mobile phone. The fees generated by this service were

charged to the customer's mobile bill and were shared between the bank and carrier. The range of services has since increased substantially although revenue generated from m-commerce remains relatively small. In most m-commerce transactions, revenue is split between the mobile service provider, which provide the infrastructure to facilitate the transaction, and the merchant, which provides the service or content.

Mobile commerce services that are driving revenue growth are those targeted at teenagers and young adults, such as ring tones, icons, wallpapers, games and premium SMS for reality TV voting and competitions. A contentious digital content service that is being reviewed is adult content. ACMA has guidelines that allow selected material to be viewed but has set conditions for the delivery of such material so as to check identification and ensure that young people are not inappropriately exposed to such content.

Further penetration of m-commerce solutions may depend on agreements between mobile carriers and merchants, payment security, costs to introduce the service, simplicity of use, and non-prohibitive pricing.

Mobile phones are also now being used to purchase goods from various merchants. Items that could potentially be purchased using a mobile phone include groceries, event and cinema ticketing, and small items such as newspapers, magazines and coffee from selected retailers.

Consumers can also use their mobile phones to pay for parking (such as at Sydney's Bronte Beach and Melbourne's Flagstaff Gardens). Other items that are potentially suited for payment by mobiles included road tolls, postage and public transport tickets.

Innovative Event Ticketing

In June 2006, Scottish ticket company, Mobiqa, announced that it would partner with ticket.com to provide tickets to major events in the Asia-Pacific region. The technology allows users to access events via a barcode that is sent to a mobile phone via SMS. The barcode is simply scanned and can contain other information such as event date and seat numbers. User benefits include convenience and savings for those that may otherwise have had tickets posted to their homes.

Source: IBISWorld J7122

2.2.2 CURRENT COVERAGE

The geographic spread of mobile telecommunication coverage follows Australia's demographic profile, in particular its population density. At present, Australia's terrestrial mobile network covers 98% of the population and approximately 20% of its landmass. In recent years, mobile carriers have invested considerable resources in building new base stations to expand their geographic footprint. There are currently around 15,000 base transceiver stations (BTS) throughout the country. The population coverage by each carrier and network type is summarised in Table 2-1. GSM coverage in Australia as of 30 June 2006 is illustrated in Figure 2-2.

With spectrum licences being granted on a 'nationwide', 'all cities' and an individual city or region basis, mobile subscriber access to mobile telecommunications carriers varies between states, cities and regions. For example, Sydney and Melbourne mobile users have

access to five mobile carriers while subscribers in other areas, particularly rural regions, may have access to just one or two carriers.

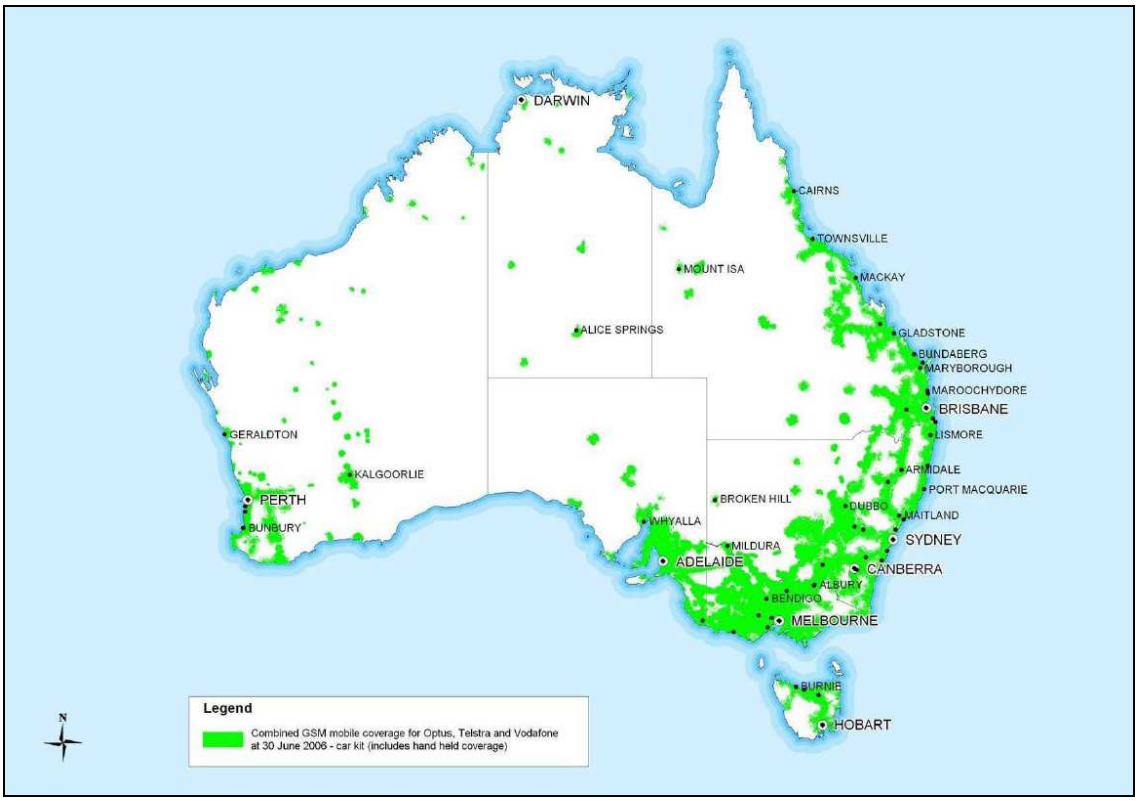
TABLE 2-1: POPULATION COVERAGE BY CARRIER AND NETWORK TYPE, 2006

Carrier	Network	No. of mobile services	Subscriber share (%)	Population coverage (%)
Telstra	GSM	6,468	32.6	96
	CDMA	1,703	8.6	98
	W-CDMA	317	1.6	98
Optus	GSM	6,555	33.0	96
Vodafone	GSM	3,683	18.5	95
Hutchison	W-CDMA	1,131	5.3	53
	CDMA	87	0.4	98

Source: ACMA
Note: Hutchison CDMA closed in August 2006

According to a report issued by the Productivity Commission in 2001, the level of mobile coverage provided to Australia's rural population was in line with that provided in New Zealand, less than that in Europe (where population densities are much higher), but greater than that in the United States.[7]

FIGURE 2-2: GSM COVERAGE IN AUSTRALIA AS OF 30 JUNE 2006



Source: ACMA, *Communications Services Availability in Australia Report 2005-06*, July 2007

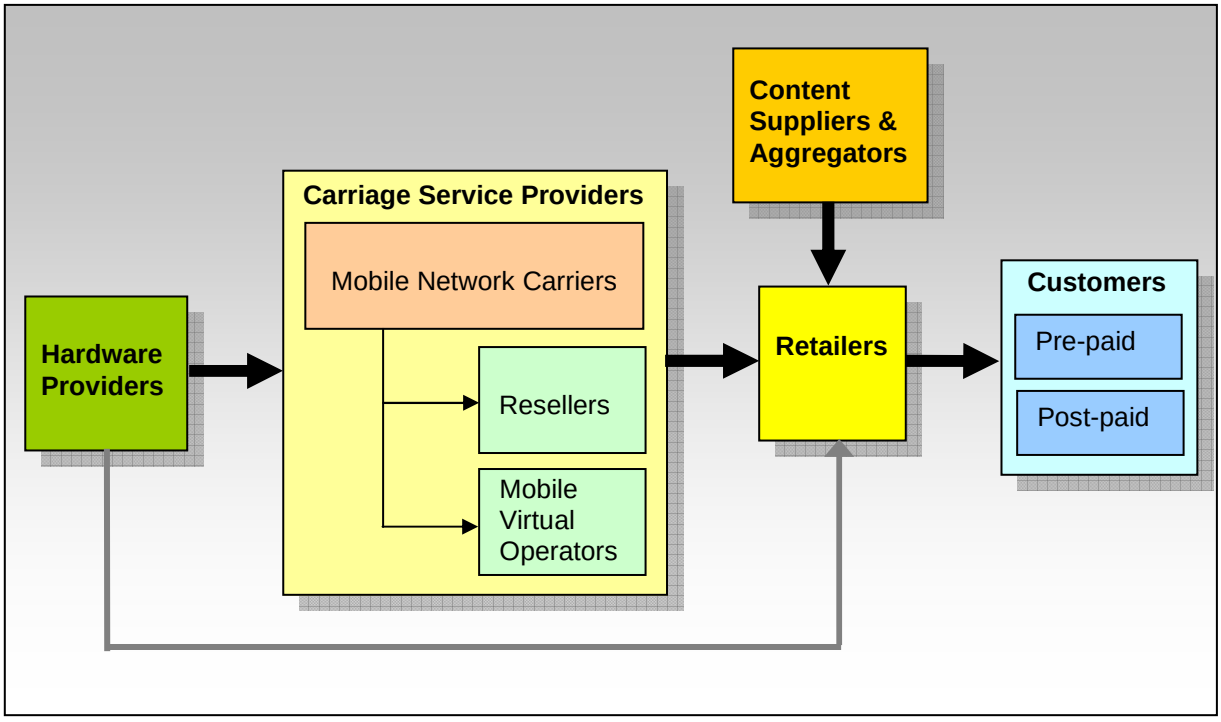
[7] Productivity Commission, *International Benchmarking of Remote, Rural and Urban Telecommunications Services*, July 2001, p xiv, at http://www.pc.gov.au/research/benchmrk/rarts/finalreport/rarts.pdf.

2.3 CURRENT INDUSTRY STRUCTURE

Mobile telecommunications require the following entities to work together (see Figure 2-3).

- hardware providers – both infrastructure and end-user hardware
- carriage service providers – mobile network carriers, resellers and mobile virtual network operators
- content service providers and aggregators
- retailers

FIGURE 2-3: THE MOBILE TELECOMMUNICATIONS INDUSTRY



Source: Access Economics

Some industry businesses operate across several sectors, especially carriage service providers, who also tend to provide retail services. Each sector is discussed briefly below.

2.3.1 HARDWARE

Manufacturers play a key role in the value chain of the Australian mobile telecommunications industry with synchronised interactions between manufacturers, carriage service providers, retailers and content providers.

This manufacturing sector, sometimes referred to as the hardware sector, is responsible for building and maintaining the extensive telecommunications network that delivers mobile telephony services to Australia's 20 million subscribers as well as supplying handsets and associated equipment to end-users.

To make and receive a call on a mobile telephone requires extensive infrastructure, including base stations, switching equipment, antennas and towers. Manufacturers are involved in the

construction, installation and maintenance of base stations, which are owned and operated by the carriers.

Ericsson Australia, Alcatel-Lucent and Nokia Siemens provide infrastructure hardware to the Australian mobile telecommunications market. For example, Ericsson provides Hutchison Australia with an end-to-end managed service solution covering build-out and day-to-day network operations, including Hutchison's 3G, network and services platforms.

The hardware sector manufactures and supplies handsets allowing end-users to access telecommunications services. One of the most personal aspects of the industry is the handset which represents the key enabling link between consumer and mobile network services.

ATMA member companies are the leaders in handset technology in a market where shipments of handsets have grown substantially in recent years. The AMTA members who supply products to meet consumer demand and drive market growth include: Nokia, Motorola, Samsung, LG, Sony Ericsson, i-Mate and RIM (see the box on the following page)

GPS Navigation and Mobiles

After hitting alarm clock makers and camera manufacturers, the mobile phone industry has a new target — personal navigation device makers. Handset makers see navigation as one of the next major value-adding offerings and even at this very early stage, analysts say the annual market for phone navigation is worth hundreds of millions of dollars.

The GPS technology enables handset makers to bypass mobile phone network operators, and at least some of the navigation phones can be used for routing when not connected to operators' networks.

Operators would get a share of the business when real-time data traffic starts to grow. Handset makers dream that people will use phones to find restaurants nearby, but car navigation firms have already started to offer road data.

According to researchers Canalys, the navigation products market is set to grow in 2007 by about two thirds from last year, with traditional personal navigation devices (PND) taking 85 per cent of the market. Analysis firm Berg Insight forecast annual shipments of handset-based personal navigation products in Europe and the US to reach 12 million units by 2009, compared with 1 million in 2005.

Nokia, which bought into the navigation industry in 2006 with the acquisition of German firm Gate5, rolled out a free Nokia Maps service in February 2007, giving away maps and routing data while charging consumers for a turn-by-turn navigation service. Built-in GPS mapping can be found in Nokia phones such as the high-end N95, which also incorporates a 5-megapixel digital camera with Carl Zeiss optics, as well as the Nokia 6110 Navigator.

Google and Yahoo are keen to add mobile navigation services to their mapping offerings, while car navigation firms are adding mobile services to their products.

Source: “Phone Makers Embrace GPS”, *The Age*, 3 May 2007

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Handset Manufacturers and Providers

Nokia Australia

Nokia began operations in Australia in 1985 as a network infrastructure business helping build the country's mobile telecommunications networks. Nokia sold its first mobile phone in Australia in September 1993 and quickly became Australia's number one mobile manufacturer — a position it still holds today.

Nokia is the world leader in mobility, driving the transformation and growth of the converging Internet and communications industries. Nokia makes a wide range of mobile devices, the vast majority of which have become available in Australia, and provides music, navigation, video, television, imaging, games and business mobility through these devices.

Nokia also provides equipment, solutions and services for communications networks. Nokia Australia employees 100 people in Australia and also has 13 Nokia Care Centres located nationwide servicing the needs of consumers and the nearly 6000 retailers which sell Nokia products

Motorola

Motorola, has been a global pacesetter in communications technology, semiconductors and advanced electronic systems since the 1930s, and today is a major force behind personal, enterprise, emergency, government and law enforcement communications in Australia and the Pacific region.

Motorola's approach to design humanises leading edge technology and delivers seamless mobility — connecting Australians with easy, uninterrupted access to people, information, and entertainment. This is done by designing and delivering quality products, experiences and networks — along with a full complement of support services.

After launching the popular handset MOTORAZR in 2005, Motorola is now introducing the next generation MOTORAZR 2 and the QWERTY Smartphone MOTO Q 9h, providing Australian consumers with enhanced experiences in music, video, imaging and browsing.

Samsung Mobile

Samsung, the world's number three manufacturer of mobile handsets, focuses on delivering premium quality, superior designed, multi-media mobile phones.

Major innovations in these areas include: the first 10-megapixel camera phone; eight mobile TV phones across four different broadcasting services; the first 8GB hard disk drive (HDD) embedded music smartphone; and the fastest High Speed Downlink Packet Access (HSDPA) technology.

LG

LG, a major mobile phone brand, has been supplying mobile phones to stores and consumers in Australia since 2001. It has helped introduce 3G technologies to the Australian market and driven technology uptake and investment.

LG provides a wide range of handsets to suit a broad range of customers' needs. By investing heavily in the development, promotion and support of these handsets, LG has contributed to the success of numerous Australian businesses.

Handset Manufacturers and Providers (Continued)

Sony Ericsson

Sony Ericsson Mobile Communications serves the Australian communications market with innovative and feature-rich mobile phones, accessories and PC-cards.

Established as a joint venture by Sony and Ericsson in 2001, it employs more than 30 people nationally and 5000 globally. Sony Ericsson Australia works closely with other Sony group companies and operator partners to merge content and hardware and deliver improved consumer experiences.

With a focus on providing mobile communications and entertainment — particularly music and imaging — Sony Ericsson offers a portfolio of 48 phones and 82 accessories that offer stylish design and the latest functionality.

i-Mate

i-mate, founded in 2001, is a leader in the design, development and customisation of Smartphones and Pocket PCs, based on Microsoft Windows Mobile software.

The mobile content and applications offered on the i-mate devices have helped i-mate to secure leading positions in several territories, with product distribution across the Middle East, Eastern and Western Europe, Africa, New Zealand and Australia.

Working in partnership with Australia's mobile operators, i-mate is a fast growing mobile vendor with strong take-up among Australian business industry sectors. Customers are increasingly adopting i-mate mobile devices due to the value added services and extensive support.

Research In Motion (RIM)

Research in Motion is a designer, manufacturer and marketer of innovative wireless solutions for the worldwide mobile communications market. Through the development of integrated hardware, software and services that support multiple wireless network standards, RIM provides platforms and solutions for seamless access to time-sensitive information including email, phone, SMS messaging, Internet and intranet-based applications.

RIM technology also enables a broad array of third party developers and manufacturers to enhance their products and services with wireless connectivity to data. RIM's portfolio of products, services and embedded technologies are used by thousands of organizations around the world and include the BlackBerry® wireless platform. Founded in 1984 and based in Waterloo, Ontario, RIM operates offices in North America, Europe and Asia Pacific.

Source: AMTA and handset manufacturers

2.3.2 CARRIAGE SERVICE PROVIDERS

Carriage service providers (CSPs) provide telecommunications services to households and businesses using carrier network infrastructure.

Mobile network carriers

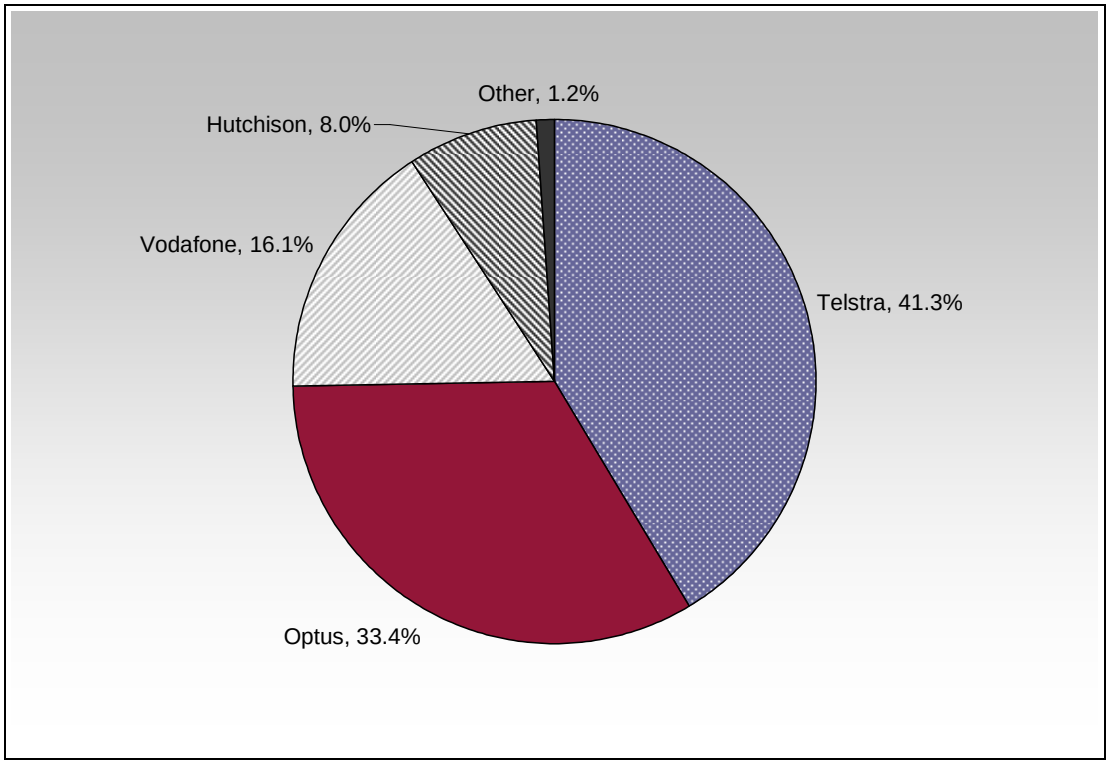
Mobile telecommunications carriers are primarily engaged in operating and maintaining switching and transmission facilities that provide direct communication via airwaves. Included in this industry are establishments providing wireless telecommunications network services, such as mobile telephone or paging services and other wireless telecommunication networks.

The early 1990s heralded the start of a fundamental and structural metamorphosis of the Australian mobile telecommunications market. Reflecting the global trends occurring in the general telecommunications industry, the Australian Government announced a program of staged liberalisation of the telecommunications sector in November 1990. In November of the following year, Optus was admitted into both the long-distance and mobile markets as the nation's second national carrier. Optus commenced mobile service operations in June 1992 and a third mobile carrier licence was issued to Vodafone in 1993. Hutchison Telecommunications first entered the mobile telephony market as an analog reseller and was granted a carrier licence in September 1998 to become a full GSM service provider.

Today, the mobile network carriers continue to be Telstra, Optus, Vodafone and Hutchison. They hold licences to use spectrum space required for telecommunications services and offer a variety of mobile services to customers using their networks.

Spectrum space is a pre-determined multi-dimensional area where the dimensions are geographic area and radiofrequency bandwidth. Spectrum licence holders may deploy any device within their spectrum space for 15 years, subject to stringent out-of-band and out-of-area constraints that prevent interference with their neighbours.

FIGURE 2-4: MARKET SHARE OF MOBILE NETWORK CARRIERS BY REVENUE, 2006



Source: IBISWorld J7122

IBISWorld estimates that in 2006-07, pre-paid customers will account for 45% of mobile network carriers' aggregate revenues, with post-paid and business subscribers accounting for 30% and 25% respectively. The market shares of the major mobile network carriers are shown in Figure 2-4 above. Table 2-2 shows the number of subscribers for each carrier by network type between 2003-04 and 2005-06.

TABLE 2-2: PRODUCT SEGMENTATION BY CARRIER, 2003-04 TO 2005-06

Segment	Subscribers ('000) 2003-04	Subscribers ('000) 2004-05	Subscribers ('000) 2005-06
Telstra			
3G	n.a.	n.a.	317
GSM	6659	6923	6468
CDMA	1006	1394	1703
Optus			
GSM	5689	5989	6555
Vodafone			
GSM	2498	3167	3683
Hutchison			
Orange CDMA	386	418	n.a.
3G	238	532	1131
Total	**16476**	**18423**	**19857**

Source: IBISWorld J7122

Note: Orange CDMA closed in August 2006

Resellers

Mobile telecommunications resellers provide telecommunications services by use of a network owned by a third party but bill customers in their own names. Some own switching equipment while others simply buy and resell telecommunications services. They usually do not have a spectrum allocation. An example of a reseller is Primus Mobile, which resells Optus GSM services.

Mobile virtual network operators

Mobile virtual network operators (MVNOs) offer mobile services to customers using a third party's network, in order to avoid the heavy capital investment required to establish their own networks. Unlike resellers, MVNOs purchase *wholesale* mobile capacity from network carriers. For example, AAPT purchases wholesale mobile capacity from Vodafone while Virgin Mobile did so from Optus prior to its acquisition by Optus in early 2006. The characteristics of MVNOs include:

- bringing existing and well-known consumer brands to a mobile retail operation;
- using existing networks of a mobile carrier but providing a technical support layer;
- operating their own pre-paid and post-paid billing as well as providing value added services (such as voice mail box) and facilities; and
- generally exerting control over their subscriber information, independent of the mobile carrier.

Cost Structure of Mobile Carriers

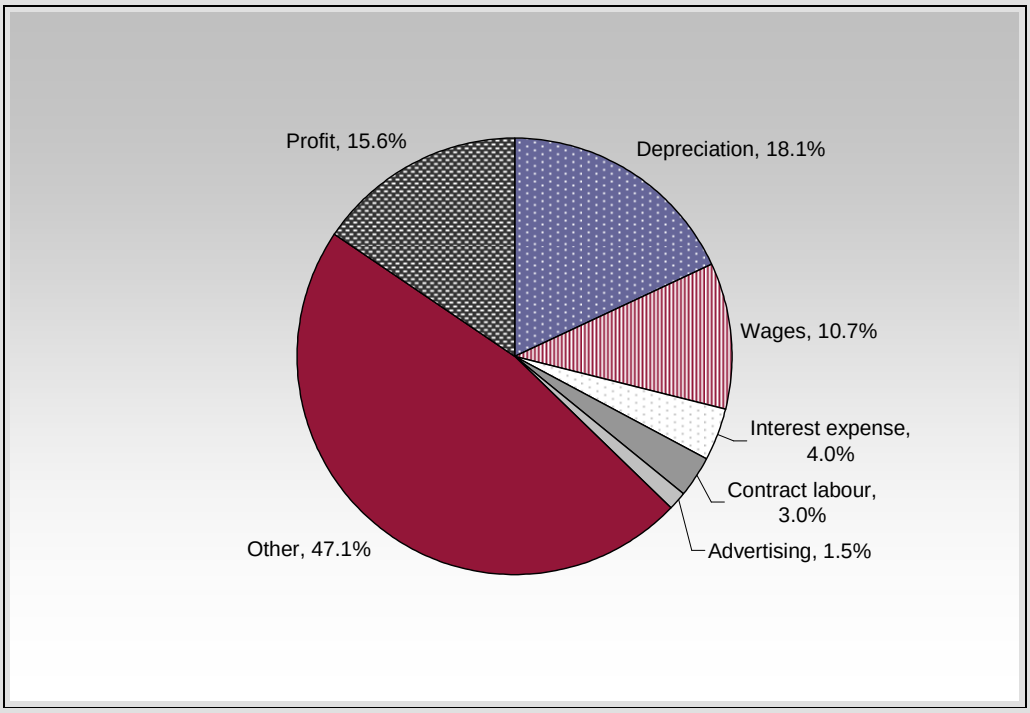
According to IBISWorld, wages will account for 10.7% of mobile carriers' revenues in 2006-2007, compared to 12.1% in the entire telecommunications services sector (see chart below). The mobile carriers sector is capital intensive and depreciation expense is high (accounting for an estimated 18.1% of industry revenue in 2006-2007), which reflects a substantial level of capital resources that are tied up in a carrier's networks and infrastructure. (In addition, licences also represent depreciable items.) Operating profit before tax is estimated to be 15.6% of industry revenue in 2006-07, 1.4 percentage points lower than in 2005-06. This average masks significant differences in profitability between carriers — as the industry is driven by economies of scale, larger players generate considerably higher returns than smaller players. The importance of economies of scale explains why carriers have been so aggressive in acquiring customers.

Similarly, the relatively high level of interest expense reflects the cost associated with the roll-out of new networks and the upgrade of legacy networks.

Australian mobile carriers spent around $125 million on advertising in 2004-05 according to Nielsen Media Research. IBISWorld estimates that in 2006-07, advertising expense will account for around 1.5% of industry revenue. This share has increased in recent years, as carriers have sought to educate and migrate customers to their new 3G networks.

The bulk of 'other expenses' (amounting to 47.1% of revenues) may be attributed to carrier payments, which are payments to other mobile carriers for mobile calls made which terminate on other carrier's mobile networks. However, it is difficult to ascertain the true interconnection or inter-carrier costs as they may differ between providers.

COST STRUCTURE OF MOBILE NETWORK CARRIERS, 2007 (ESTIMATED)



Source: IBISWorld J7122

MVNOs in Australia include larger players such as B Digital, Revolution, Boost Mobile, Primus Telecom, People Telecom and Macquarie Telecom, along with smaller players such as M8 Telecom, Dodo Telecom, Austar and ThinkMobile. Crazy John's, Australia's largest independent mobile retail chain, has announced plans to enter the MVNO market, utilising the Vodafone network.

2.3.3 CONTENT

Content service providers

Content service providers deliver information and entertainment services, which are sourced and purchased from a variety of channels before being structured and bundled for distribution over mobile networks. Value is added to the mobile entertainment value chain through the delivery of useful content in a format appropriate for mobile distribution. The advent of 3G mobile services has increased the importance of the role played by content service providers. Commercial arrangements between carriers and content providers enable customers to readily access entertainment services on their mobiles.

Content aggregators

Content aggregators manage multiple content providers and provide services through content linked to these providers' products such as sourcing, reporting, formatting for multiple streams, quality control and cross-referencing.

Aggregators also add value by negotiating complex and time-consuming distribution deals with the individual network carriers, resulting in wider content distribution. They benefit carriers by creating valuable mobile data applications through the combination of content from numerous sources and their integration into a single interface. Examples of Australian content aggregators are Legion Interactive, Infospace and iTouch.

Creative Content for Mobile Phones

The Sundance Film Festival used the mobile phone industry's 2007 3GSM event held in Barcelona to unveil results of a project to showcase short films designed for mobile phones.

The Sundance initiative, launched last year with the backing of Hollywood actor Robert Redford, illustrates the close ties between the telecommunications and entertainment industries. Mobile phones are seen as a vital new distribution channel for creative material.

"We hope that the Global Short Film project inspires filmmakers and artists to think outside the realm of traditional venues for cinema and experiment with mobile as a new avenue for their work," said Sundance Festival programming director John Cooper.

The six participating filmmakers in the Sundance project included the directors of the hit Toni Collette film Little Miss Sunshine, who produced a clip about slapstick comedy.

This year's conference, one of the world's biggest events for the wireless industry, has a dedicated exhibition space for entertainment companies for the first time, featuring Yahoo, MTV and Warner Music.

Source: "Hot Times Coming for Mobiles", *The Australian*, 20 February 2007

Program developers

Program developers use industry development tools to create new and innovative applications for mobile phone users, thereby expanding services available via mobile phones.

2.3.4 RETAILERS

Retailers offer mobile services to end users on behalf of carriage service providers. Retail outlets can be categorised into:

- speciality outlets that may be branded and are sometimes owned by a CSP;
- outlets that sell mobile telecommunications hardware and services as part of a broad range of products; and
- on-line sellers.

Most CSPs have their own retail shops where customers can purchase the hardware required to access mobile services and enter into contracts and other arrangements to use the network hardware infrastructure. Access is achieved via a pre-paid arrangement or an ongoing post-paid basis where customers are regularly billed for services used.

Google's Mobile Plans

"Mobile, mobile, mobile," Google CEO Eric Schmidt told the Web 2.0 Expo audience in April 2007 when asked for the Web's biggest growth areas.

Mobile AdWords have done well for Google, but "there are probably other monetization means in mobile as well," Deep Nishar, Director of Product Development at Google said at a separate conference in Tokyo. (In Google AdWords, links to businesses appear next to a user's search results.) Google currently has deals with the two main Japanese carriers, NTT DoCoMo and KDDI, to provide mobile search for a combined 71 million handsets.

So where is Google going next? The recent release of a free voice-driven mobile search is one indication. Google's chief executive for Spain and Portugal has also confirmed that the company is working on its own mobile phone "as one of 18 R&D initiatives."

Source: www.FierceDeveloper.com

The exclusive retail outlets of mobile network carriers are:

- Telstra – Telstra Shops
- Optus – Optus World
- Vodafone – Vodafone-branded stores
- Hutchison – '3' stores

Other retailers include 'non-branded' but still speciality telecommunications or electronics retail outlets that offer hardware and services of multiple mobile network carriers; non-specialty stores such as convenience stores, petrol stations, supermarkets and Australia

Post; as well as online stores where customers can purchase end-user hardware and post-paid mobile plans in addition to ordering, activating and recharging pre-paid mobile products.

2.3.5 INDUSTRY ORGANISATIONS

A list of organisations related to the Australian mobile telecommunications industry is given in Appendix A.

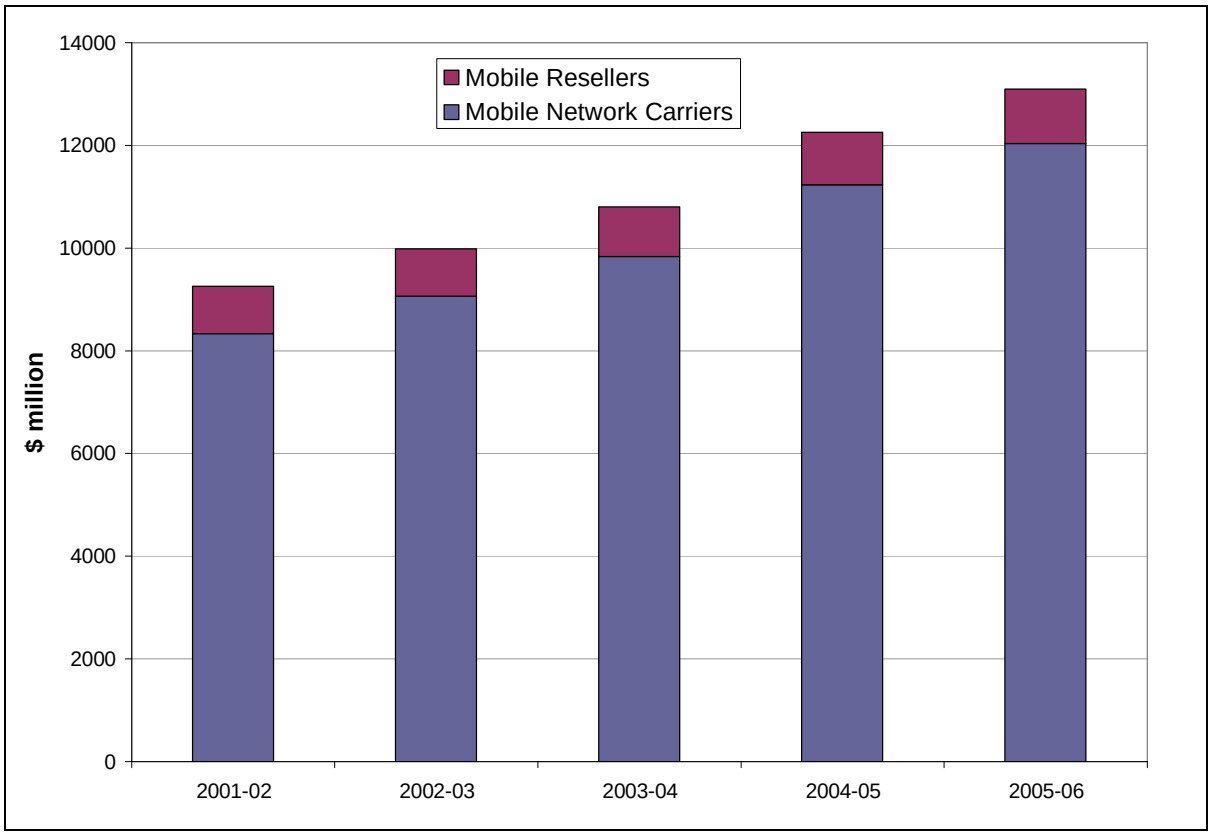
3. INDUSTRY TRENDS

Mobile telecommunications has been one of the fastest growing sectors within the telecommunications industry in the last few years. In 2005-06, there were 19.9 million mobile subscribers in Australia, implying a penetration rate of almost 97%. IBISWorld forecasts that the penetration rate would have increased to 100.3% in 2006-07. Revenues generated by mobile telecommunications carriers on voice and data services are expected to exceed fixed-line voice revenues earned by carriers in the near future.

3.1 REVENUES

In recent years, revenues in mobile telecommunications have grown strongly at an average annualised rate of 5.8% between 2001-02 and 2006-07, with the combined revenues of mobile network carriers and resellers rising steadily from $9.3 billion in 2001-02 to $13.1 billion in 2005-06 (see Figure 3-1). In addition, IBISWorld estimates suggest that carrier equipment providers generated approximately another $0.09 billion in revenues in 2005-06.[9]

FIGURE 3-1: INDUSTRY REVENUES, 2001-02 TO 2005-06

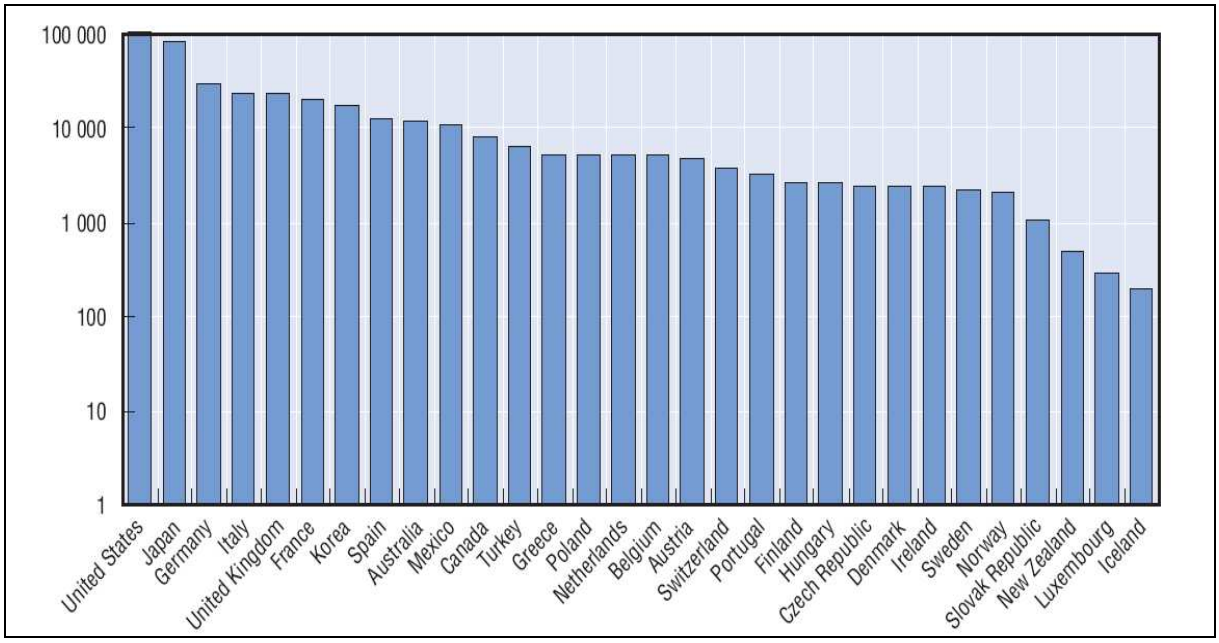


Source: IBISWorld J7122 and IBISWorld, *Industry Report J7123: Telecommunications Resellers in Australia*, January 2007

[9] This is calculated by multiplying the revenue share of 'Carrier Telephone and Telegraph Equipment' by the total revenues of 'Telecommunication, Broadcasting and Transceiving Equipment Manufacturing in Australia' and assuming that half of 'Carrier Telephone and Telegraph Equipment' revenues are attributable to mobile phones.

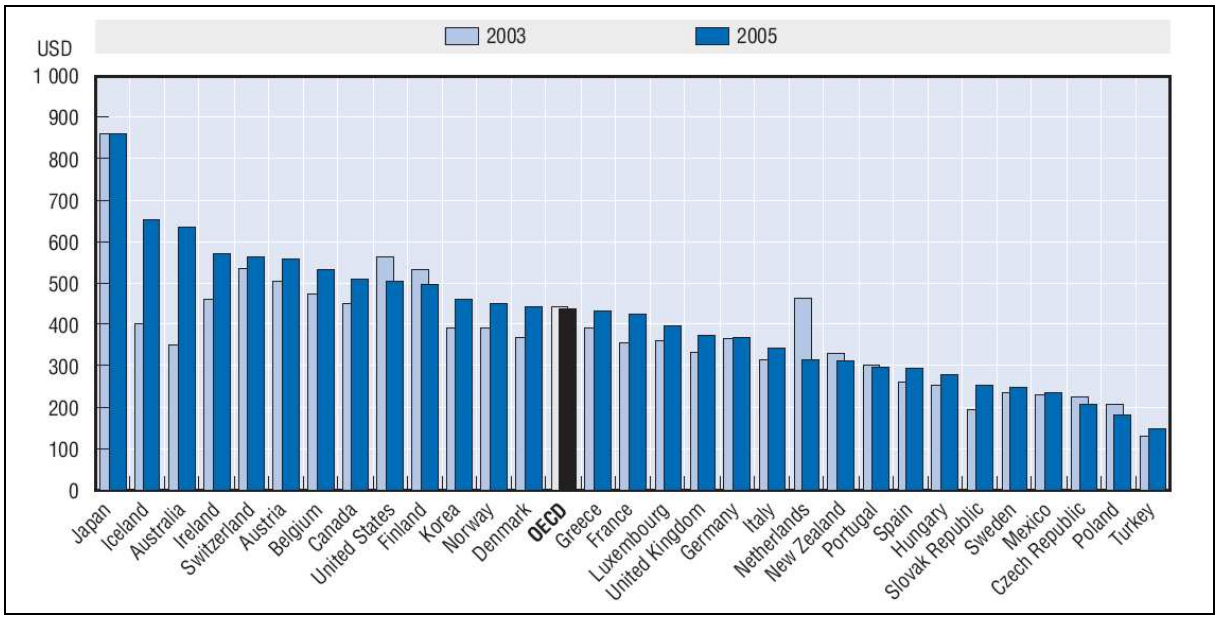
Despite its relatively small population, Australia's mobile telecommunications revenues exceed those of most other OECD countries, as can be see in Figure 3-2. Average revenue per subscriber in Australia was the third highest in the OECD in 2005 (see Figure 3-3).

FIGURE 3-2: OECD COMPARISON WITH MOBILE TELECOMMUNICATIONS REVENUES, 2005



Source: *OECD Communications Outlook 2007*, p 76

FIGURE 3-3: AVERAGE REVENUE PER SUBSCRIBER, 2003 AND 2005 (USD)

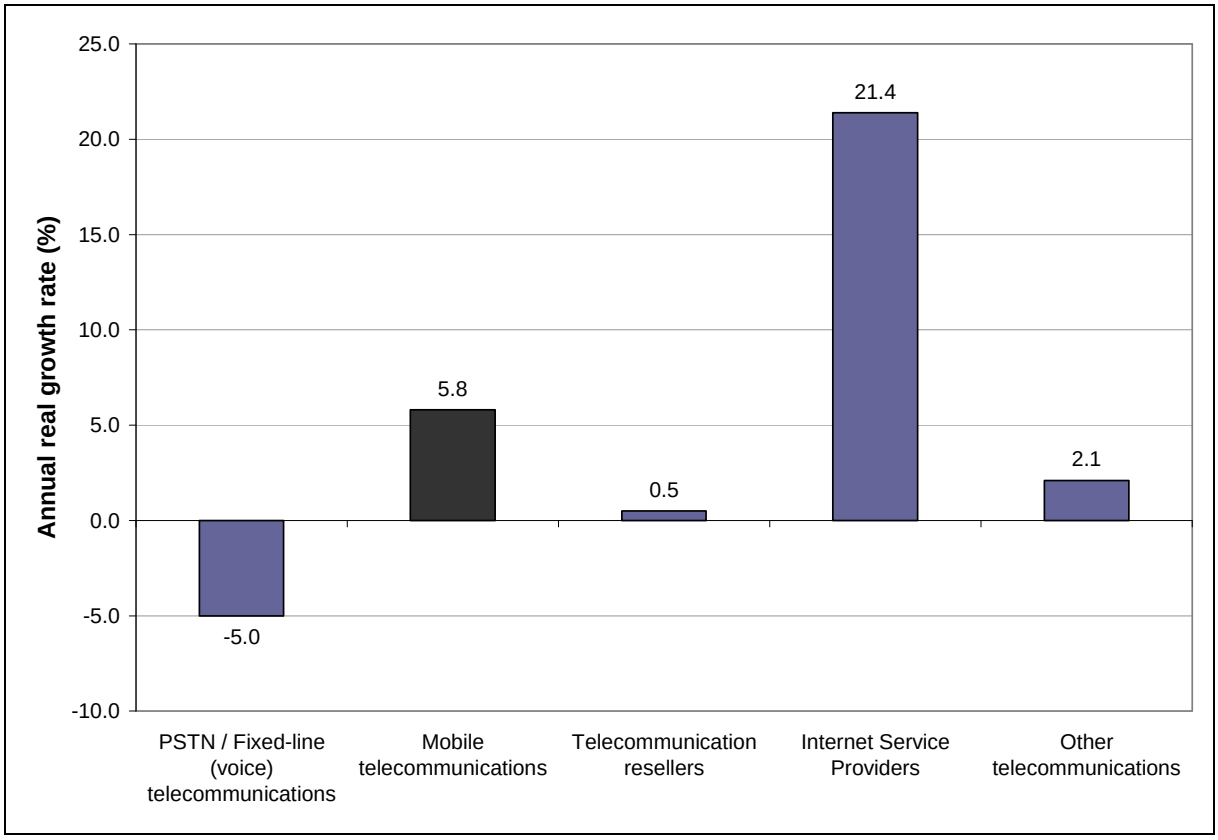


Source: *OECD Communications Outlook 2007*, p 77

The growth in mobile telecommunications revenues for voice and data services contrasts with the performance of the fixed-line or public switched telephone network (PSTN), where real revenues decreased by an average of 5% a year over the same period (see Figure 3-4). It should be noted though that as these do not include data services — they only account for

fixed-line voice revenues — it is likely to overstate the true decline in revenues obtained from all services provided over the fixed-line network.

FIGURE 3-4: REAL SECTOR ANNUALISED REVENUE GROWTH RATES, 2001-02 TO 2005-06



Source: IBISWorld J7122

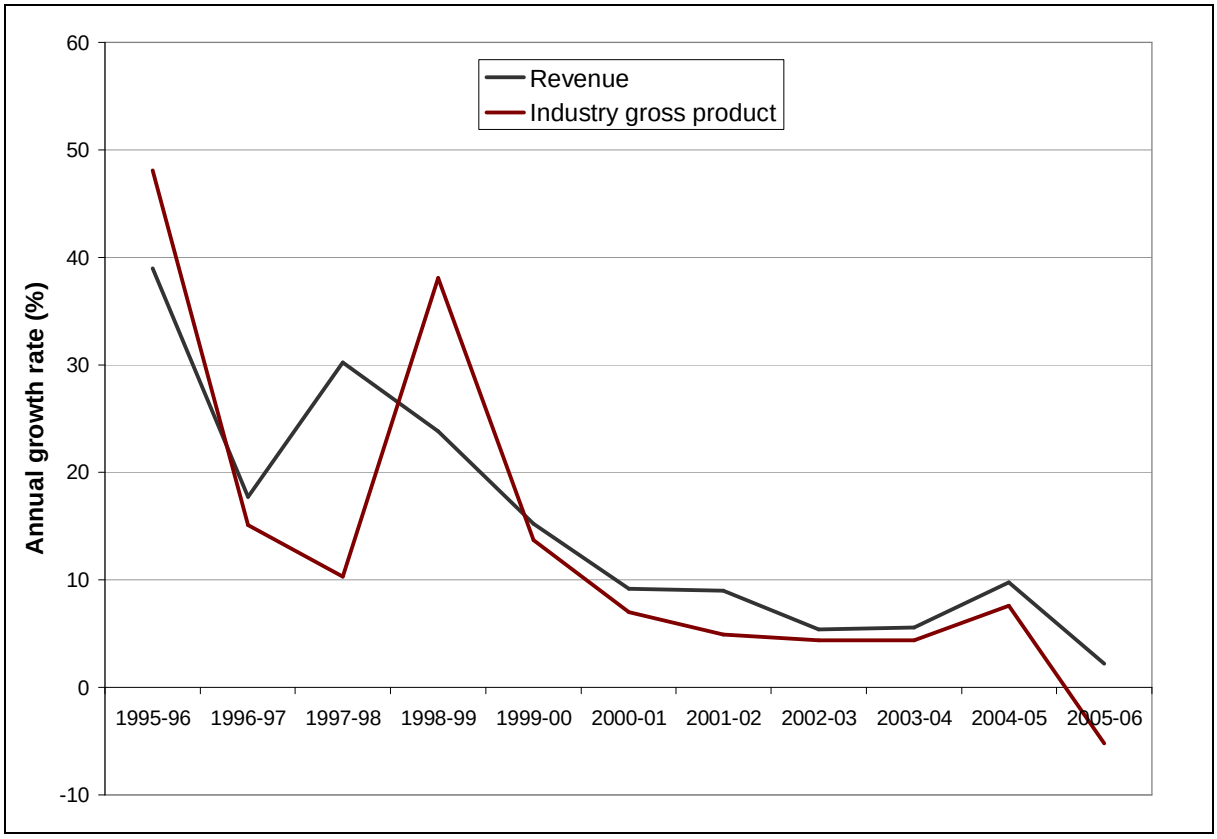
Note: In 2005-06 constant dollars

The average growth rate in revenues generated by mobile telecommunications since 2000, however, is lower than that for the second half of the 1990s. In particular, as can be seen in Figure 3-5, annual revenue growth for mobile carriers peaked at 30% in 1997-98 and declined to less than 10% by 2000-01. This suggests a maturation of the sector, at least with regards to 2G technology. If uptake of 3G technology (along with the new data services made possible by its enhanced capabilities) increases, then there is a possibility that revenue growth will pick up once again in the near future.

Mobile data is expected to remain a key driver of revenue growth in the near future, particularly premium SMS services (such as competitions) and MMS pictures messages as the proportion of camera-equipped handsets continue to rise.

Another source of revenue growth has been the sale of ring tones to younger subscribers. Improved handset technology has enabled ring tones to be polyphonic rather than monophonic and for ring tones to match their favourite songs. According to the Australasian Performing Rights Association (APRA), licensing revenues from ring tones for artists and record labels, had grown from $30 million in 2003-04 to an estimated $40 million in 2004-05. In Britain, the mobile ring tone market is thought to be larger than the single CD market. Given the increasing demand in Australia, the Australian Recording Industry Association (ARIA) is reportedly considering introducing a ring tone chart in the future.

FIGURE 3-5: ANNUAL GROWTH RATES OF REVENUE AND INDUSTRY GROSS PRODUCT FOR MOBILE CARRIERS, 1995-96 TO 2005-06



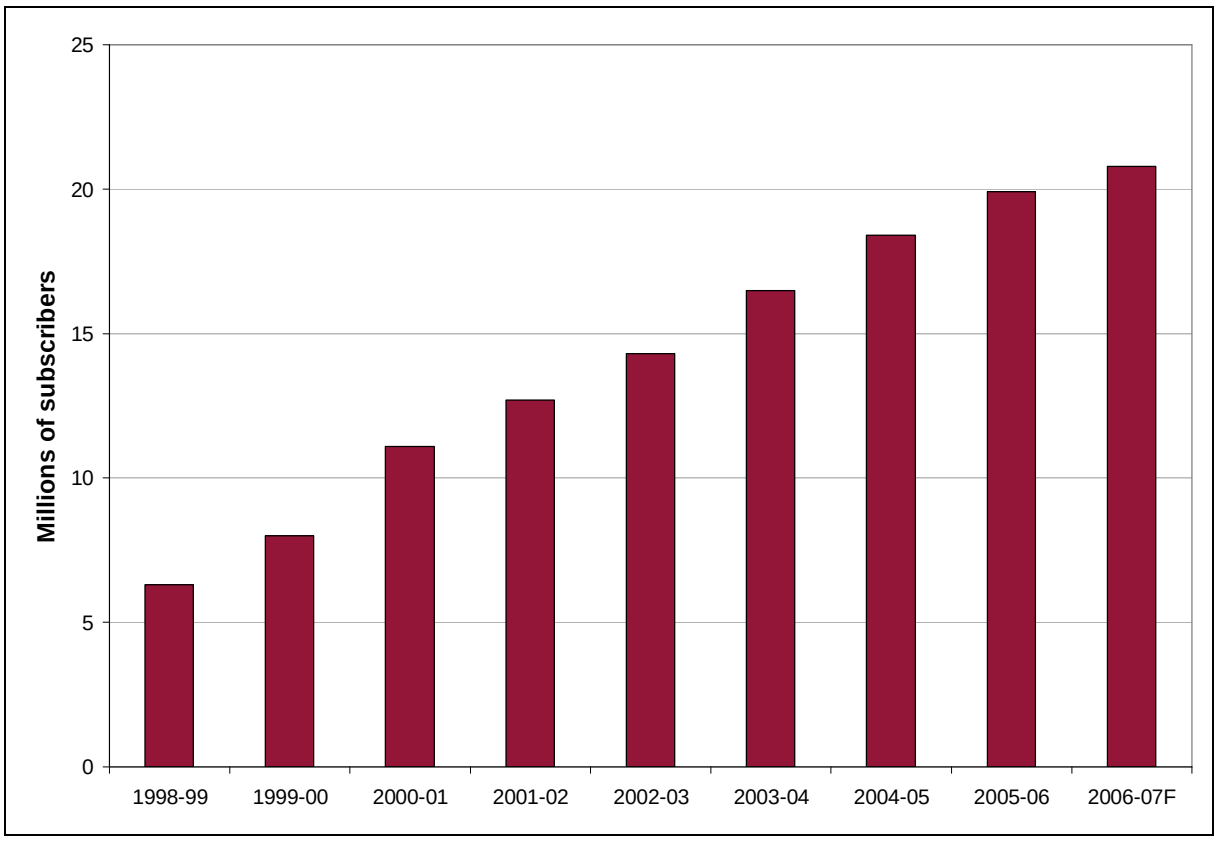
Source: IBISWorld J7122

3.2 SUBSCRIBER GROWTH

The number of mobile subscribers in Australia has increased from 6.3 million in 1998-99 to 19.9 million in 2005-06, as can be seen in Figure 3-6. However, Figure 3-7 shows that the annual growth rate of subscribers has actually declined from a peak of almost 40% in 2000-01 to just over 8% in 2005-06. IBISWorld forecasts that the growth rate will decline further to 4.5% in 2006-07. The brief subscriber growth spike in 2003-04 may be attributed to the introduction and market acceptance of capped price plans. Earlier spikes in growth rates were associated with the introduction of the second-generation GSM network in 1993 (resulting in subscriber growth of 128% in 1994) and the introduction of the CDMA networks in 1999.

The decline in subscriber growth is to be expected given the already-high mobile penetration rate and the transition of the mobile telecommunications market from its growth phase to maturity.

FIGURE 3-6: NUMBER OF MOBILE SUBSCRIBERS, 1998-99 TO 2006-07 (FORECASTED)



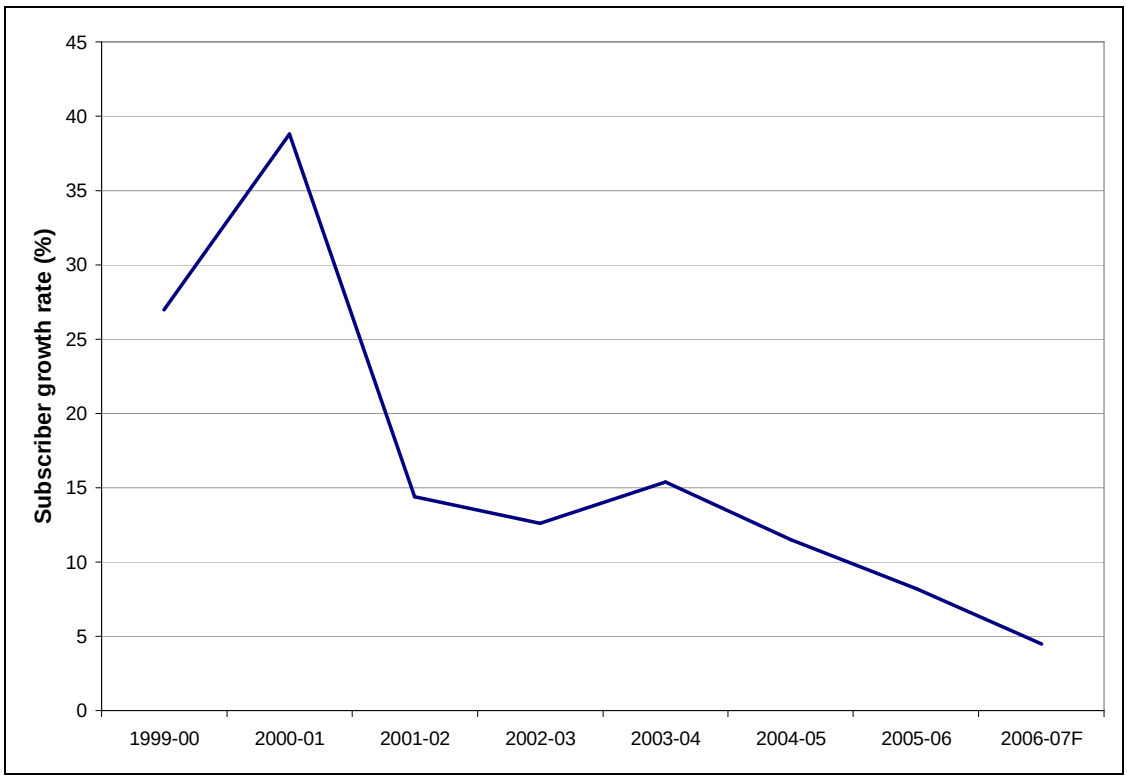
Source: ACMA and IBISWorld J7122

Note: 2006-07 is IBISWorld forecast

3.3 MOBILE PENETRATION

The increase in subscribers from fewer than 7 million in 1998-99 to 20 million in 2005-06 (of which more than 1.6 million were 3G subscriptions) has meant that the mobile penetration rate (in terms of subscribers, some of whom own more than one mobile phone or subscribe to more than one mobile phone plan) increased from just above 30% to almost 100% over this time period, as can be seen in Figure 3-8.

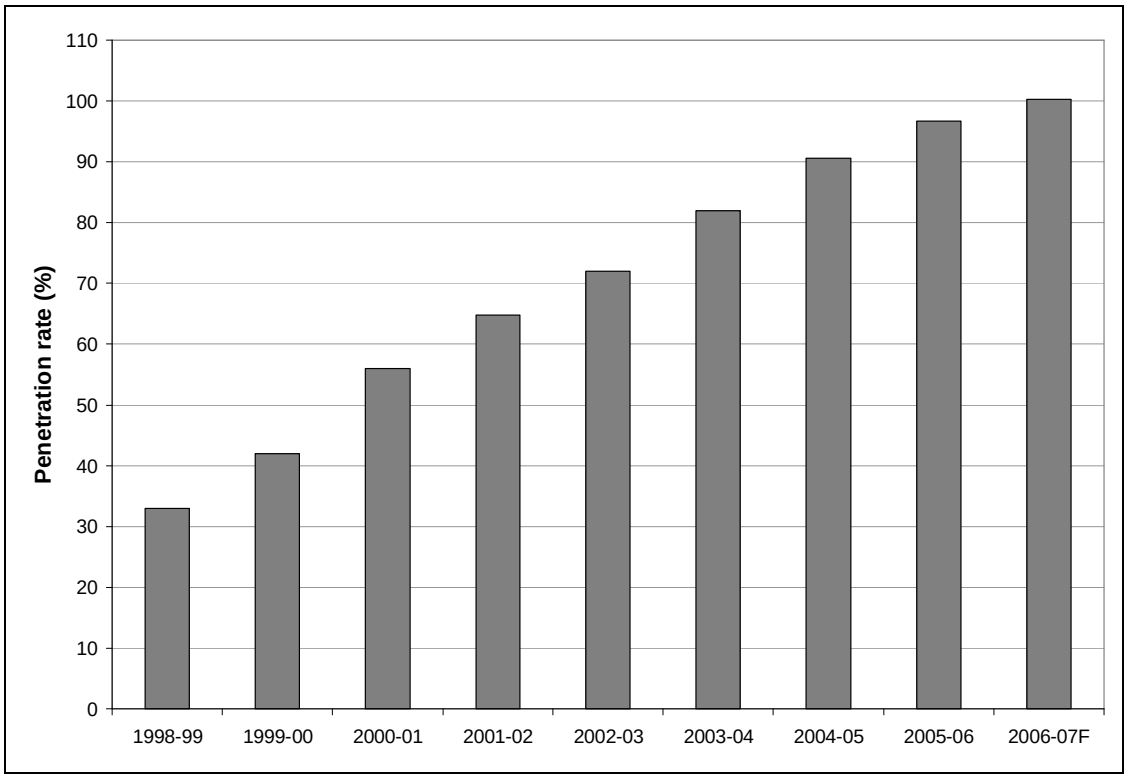
FIGURE 3-7: ANNUAL SUBSCRIBER GROWTH RATE, 1999-00 TO 2006-07



Source: ACMA and IBISWorld J7122

Note: 2006-07 is IBISWorld forecast

FIGURE 3-8: PENETRATION RATE (IN TERMS OF SIOS), 1998-99 TO 2005-06

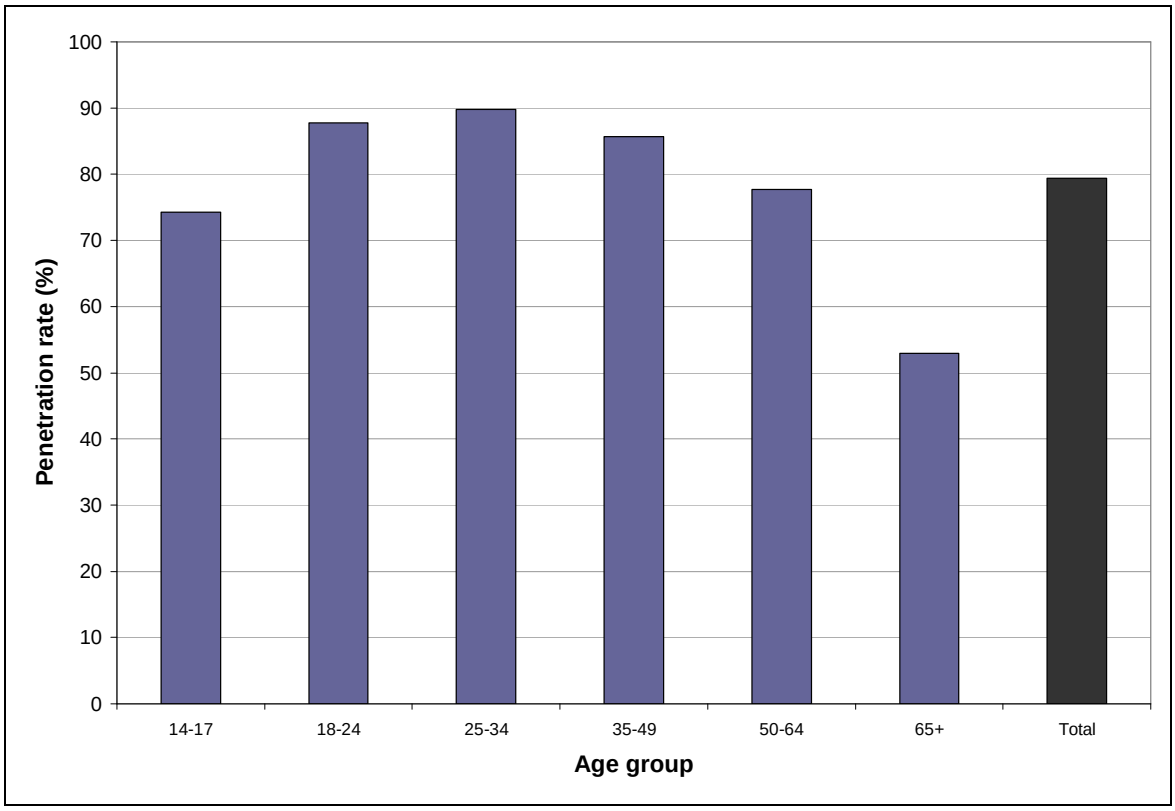


Source: ACMA and IBISWorld J7122

As may be expected, mobile penetration rates differ considerably by age. Figure 3-9 shows that 90% of those aged between 25 and 34 owned or used in mobile phone in 2005-06. By contrast, only 53% of those aged above 65 did so. Overall, 79.4% of all Australians aged 14 and above owned or used a mobile phone in 2005-06.

Analysis of penetration rates by Ovum ranked Australia about 20th worldwide, behind countries in Western Europe, Hong Kong, Taiwan, the UK and Israel for mobile phone penetration at December 2004. In its *2004-05 Telecommunications Performance Report*, ACMA also noted that United States and Canada have much lower penetration rates than Australia (65% and 50% respectively at 30 June 2005).

FIGURE 3-9: PENETRATION RATES BY DEMOGRAPHIC (% USING/OWNING A MOBILE PHONE), 2005-06



Source: ACMA

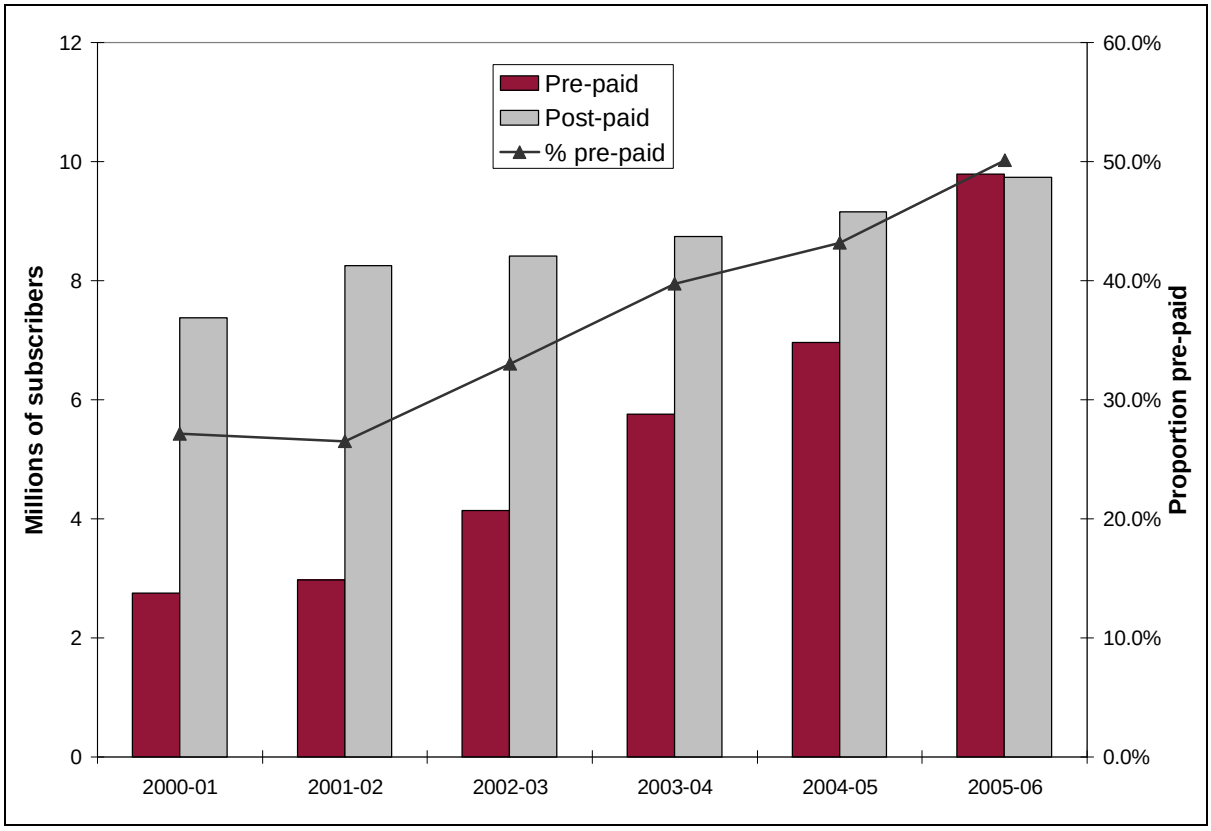
Pre-paid versus Post-paid

An important trend in many mobile telecommunications markets around the world over the last several years is the steadily rising number and proportion of pre-paid subscribers.[10] For example, by late 2004 the pre-paid mix in the highly competitive markets of Italy and the UK already stood at 85% and 66% respectively. In Australia, this proportion has increased from 27% in 2000-01 to 50% in 2005-06.

[10] According to the *OECD Communications Outlook 2007*, in 2005 "Mexico and Italy have the highest percentage of mobile users on prepaid plans, each with higher than 90%. Portugal, Ireland, the Netherlands and Turkey all have more than 70% of users on prepaid plans. In contrast, Korea and Japan have the fewest number of users on prepaid plans; these subscribers make up less than 3% of all subscribers. Finland, the United States, Denmark, Canada and Norway are also significantly below the OECD average." (p 99)

The increase in pre-paid customers has been an important driver of recent subscriber growth. In 2000-01, there were 2.8 million pre-paid subscribers versus 7.4 million post-paid ones. By 2005-06, there were just over 9.7 million of each type of subscriber. These statistics are illustrated graphically in Figure 3-10.

FIGURE 3-10: NUMBER OF PRE-PAID AND POST-PAID SUBSCRIBERS, 2000-01 TO 2005-06



Source: AMTA 2005 report (2000-01 to 2004-05), company annual reports (2005-06)
Note: Data excludes Telstra, Vodafone and 3 wholesale services

3.4 GROWTH IN MESSAGING

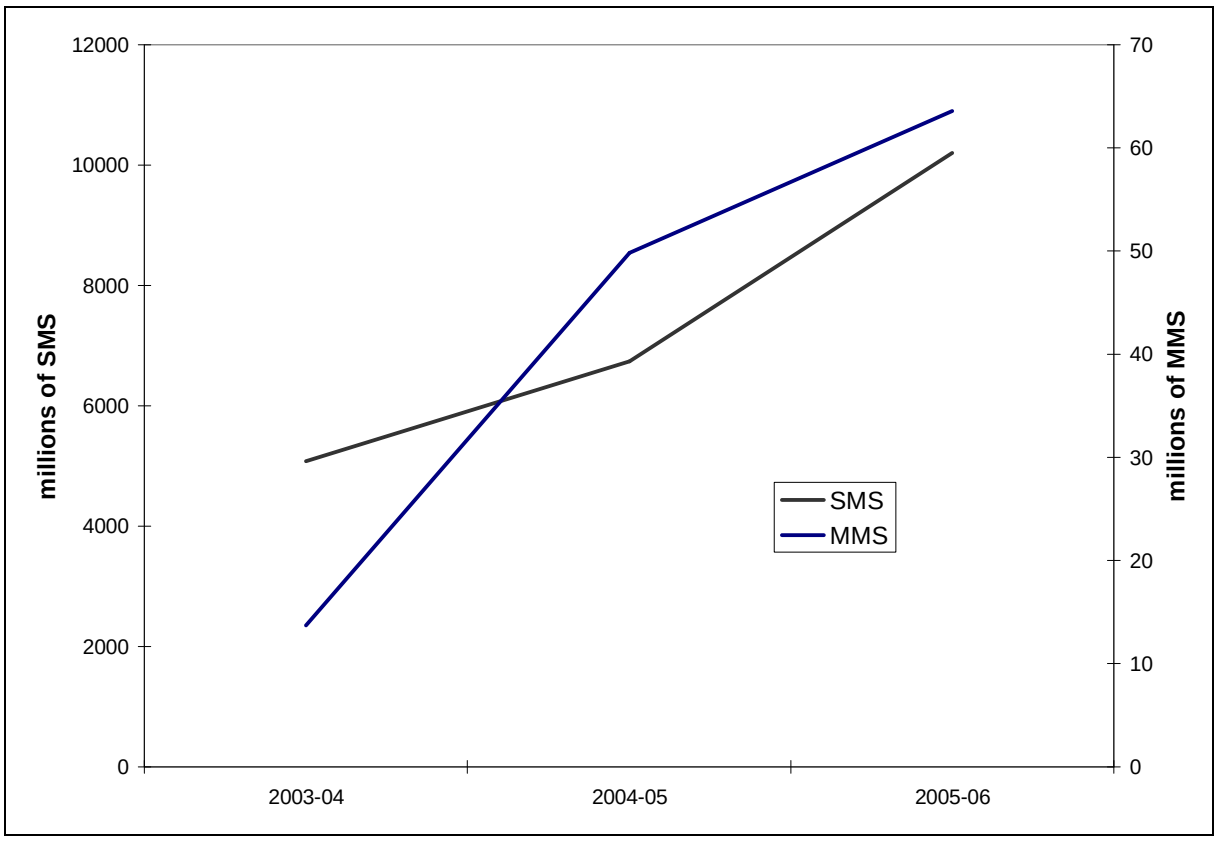
There has been extraordinary growth in the use of mobile messaging services since the start of the new millennium. According to ACMA, the number of SMS messages sent has increased from 1.9 billion in 2000-01 to 10.2 billion in 2005-06. The annual SMS growth rate fell from 72% in 2003-04 to 33% in 2004-05, and then rose again in 2005-06 to 52%.

The number of MMS messages transmitted increased from 13.7 million in 2003-04 to 63.6 million in 2005-06 (see Figure 3-11). This reflects an annual growth rate of 264% in 2004-05 and 28% in 2005-06.

Other non-voice services such as music, mobile TV, games and pure data traffic (including mobile portal browsing, PC Card connectivity, and specialised data traffic such as email using Research in Motion's BlackBerry) have also experienced rapid growth lately. Collectively, they represented almost 20% of non-voice services revenue (totalling approximately $1.45 billion or 16.7% of total service revenues) in 2005.[11]

[11] IDC, *Australia Cellular 2006-2010 Forecast and Analysis: Hopelessly Addicted*, June 2006.

FIGURE 3-11: SMS AND MMS SENT, 2000 TO 2006



Source: ACMA

Commonwealth Bank Offers Free SMS Authentication

In March 2007, the Commonwealth Bank announced that it is offering more than 2.3 million customers access to free SMS authentication as the Bank begins the final phase in its two-factor authentication program for Internet banking service, NetBank.

NetBank now provides access to NetCode SMS — a free service which allows customers with a mobile phone to receive a one-time code to authorise certain NetBank transactions. In the previous month, 30,000 highly active NetBank customers were sent a token which also produces a NetCode unique to the token and that automatically changes every 30 seconds. The customer inputs the NetCode into NetBank while logging in.

The Commonwealth Bank claimed that NetBank was the only Australian online banking service to provide all customers with access to their choice of free two factor authentication.

Source: Commonwealth Bank Media Release, 26 March 2007

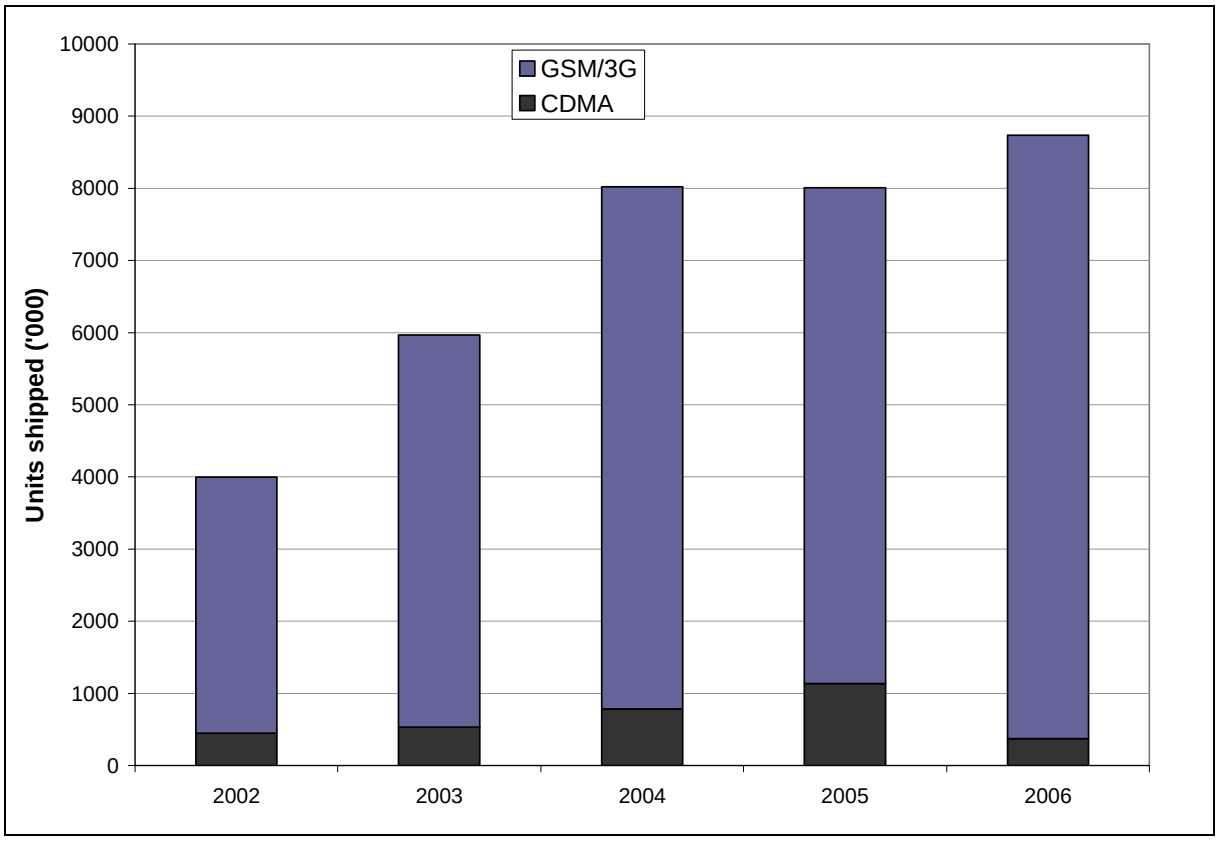
3.5 HANDSET SHIPMENTS

Mobile handsets have evolved rapidly in the last decade. While weight and size reductions were the initial focus of handset manufacturers, more recent innovations have centred on expanding the functionality of handsets. Today's mobile phones can capture and disseminate photos, play games, music (MP3 and FM radio), video and other interactive content, as well as offer information search, Internet browsing and email access on the move, among other capabilities.

As can be seen in Figure 3-12, handset shipments to Australia rose rapidly between 2002 and 2004 (doubling from 4 to 8 million) but plateaued in 2005, before rising to a record 8.7 million in 2006. In 2005, 86% of the handsets shipped Australia were of the GSM variety, compared to 14% for CDMA. By 2006, CDMA only accounted for 4% of handset shipments.

Innovations and improvements in handset design, in conjunction with handset subsidies that lock customers into 12 or 24-month contracts, have resulted in a high handset replacement rate. As can be seen in Table 3-1, according to A.T. Kearney, Australia had a handset replacement rate of 60% in 2005, indicating that more than half of all handsets were less than one year old. IBISWorld suggests that phone turnover rates are particularly high for younger customers, for whom the latest handset is a status symbol and fashion statement.

FIGURE 3-12: GSM AND CDMA HANDSET SHIPMENTS, 2002 TO 2005



Source: AMTA

TABLE 3-1: HANDSET REPLACEMENT RATES – LESS THAN 12 MONTHS OLD, 2005

Country	Handset penetration <1 year old (%)
Mexico	76
United Kingdom	69
New Zealand	68
Australia	60
United States	56
Sweden	38

Source: A.T. Kearney

Mobile Phone Industry Recycling Program

The Australian mobile telecommunications industry is committed to implementing a mobile phone recycling program that is transparent, visible and sustainable. Its primary objective is to prevent used mobile phones, batteries and accessories ending up in landfill by offering customers a free recycling service, where over 90% of the materials is recovered to make new products.

Batteries contain nickel which can be recycled to make stainless steel, while cadmium and cobalt are re-used to make new batteries. Circuit boards include small amounts of gold and silver which are recycled for use in jewellery. The plastics in the handset housings are used to make products such as plastic fence posts and pallets. Accessories include plastics and metals that are shredded and sorted, and then used to make new plastics or metal products.

By the end of September 2006, AMTA had collected over 389,000 kgs of mobile phones, batteries and accessories since the program started in 1998. This represents over 620,000 handsets and 1.65 million batteries.

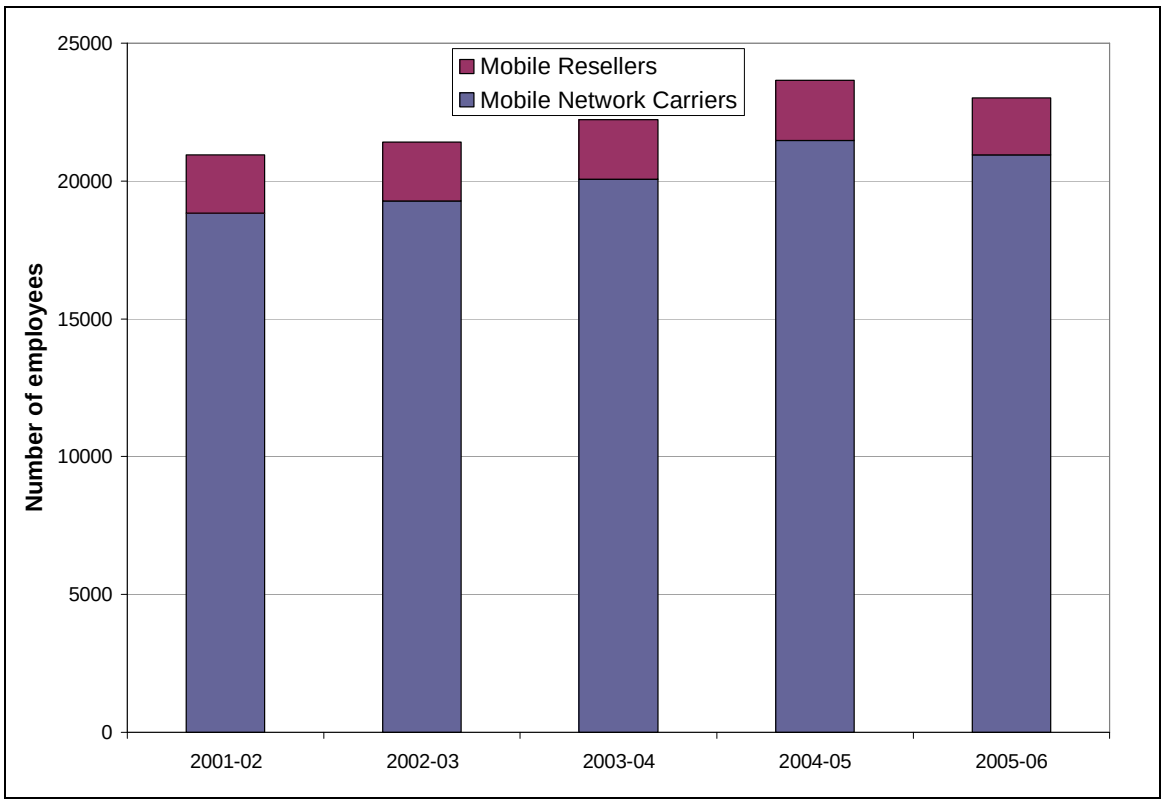
Source: AMTA, *Annual Report 2006*

3.6 EMPLOYMENT AND WAGES PAID

Between 2001-02 and 2005-06, employment by mobile network carriers increased from 18,800 to 21,000 while employment by mobile resellers decreased slightly from 6,600 to 6,500 (see Figure 3-13)

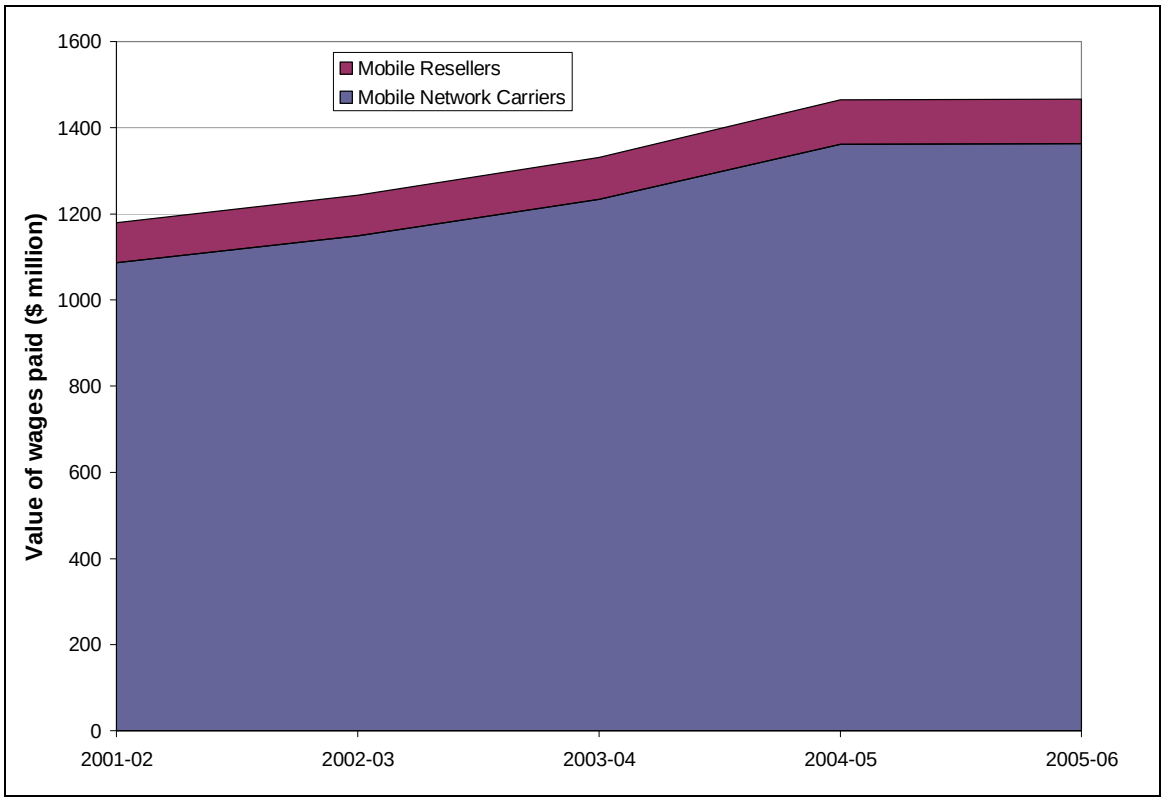
Total wages paid to workers by mobile network carriers increased from $1.09 billion in 2001-02 to $1.36 billion in 2005-06. Total wages paid by mobile resellers rose from $290 million to $320 million over the same period (see Figure 3-14).

FIGURE 3-13: EMPLOYMENT IN THE MOBILE INDUSTRY, 2001-02 TO 2005-06



Source: IBISWorld J7122 and J7123

FIGURE 3-14: TOTAL WAGES PAID, 2001-02 TO 2005-06



Source: IBISWorld J7122 and J7123

3.7 MOBILE TELECOMMUNICATIONS PRICING

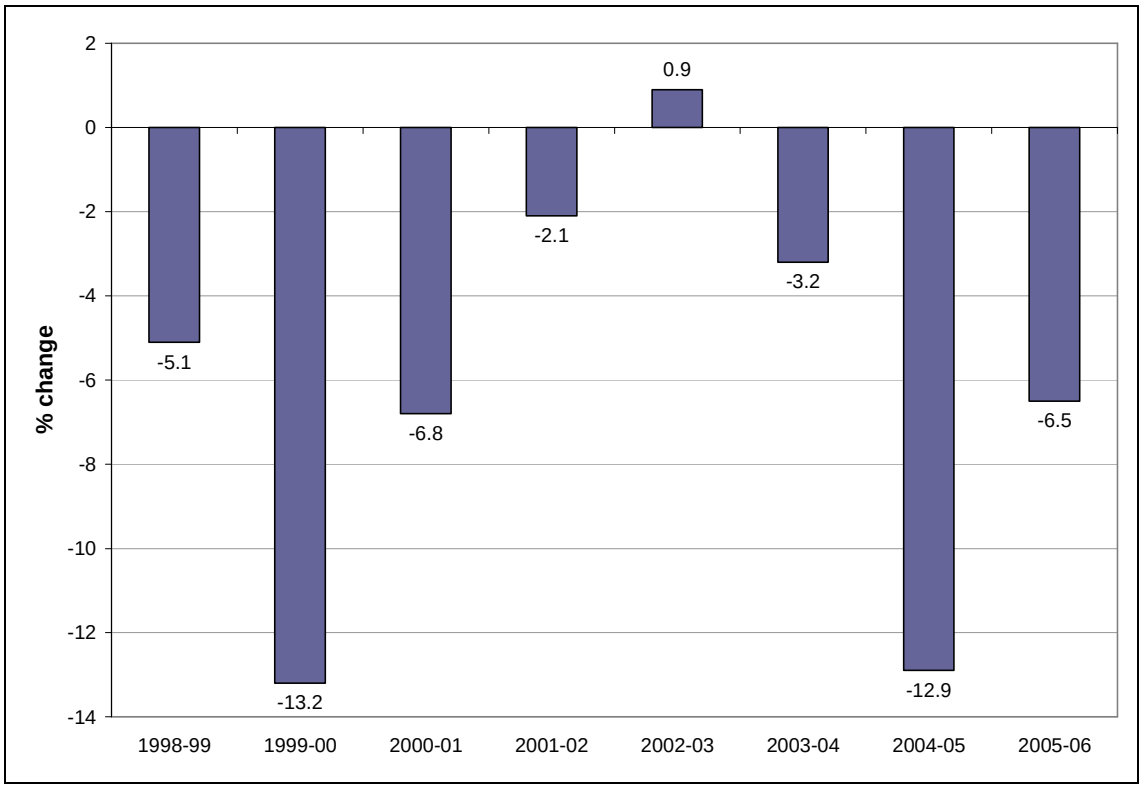
Mobile subscriber growth and the rising mobile penetration rate in the last decade has been underpinned by decreases in the average price of mobile telephony.

Between 1997-98 and 2001-02, the average price of mobile telephony fell by approximately 27% (13.2% in 1999-2000 alone). While average price decreases moderated between 2001-02 and 2003-04, average prices fell by 12.9% in 2004-05 and by 6.5% 2005-06 (see Figure 3-15). Further, ACMA data suggests that the average cost per minute fell by 15.7% and 15.5% for pre-paid and post-paid services respectively in 2005-06. Average cost per minute fell by 12.9% for business subscribers.

The recent fall in average mobile prices has been attributed in part to the growing popularity of "bucket" or "capped" plans. These plans provide mobile subscribers with a deeply discounted package of mobile services for a fixed price — e.g. a $79 cap can provide up to $500 worth of calls, text and multimedia messaging, and data services. The ACCC noting on p 98 of the *ACCC Telecommunications Reports 2005-06*[12] that that the decrease in the average price paid for mobile telephony services in 2005-06:

> *…were likely due to the growing use by consumers of capped or 'bucket' plans introduced by carriers during 2004-05, resulting in large falls in prices paid for post-paid services. Specifically, prices for GSM post-paid services fell by 10.2 per cent and prices for post-paid CDMA services fell by 3.6 per cent.*

FIGURE 3-15: PERCENTAGE CHANGE IN MOBILE TELEPHONY PRICES, 1999-2000 TO 2005-06



Source: ACCC, *ACCC Telecommunications Reports 2005-06 — Report 2*, May 2007

[12] ACCC, *ACCC Telecommunications Reports 2005-06 — Report 2*, May 2007.

Steep Declines in Data Charges

Hutchison began the slide in the cost of shifting data over Australia's 3G networks in late March 2007 by introducing a headline plan offering 2GB of data for $40 a month on its '3' network. That compared with $179 a month for 2GB on Telstra's new Next G network and charges of more than $15 a megabyte on one of Telstra's casual plans.

At the same time, Hutchison launched a range of internet applications under the X-Series brand so subscribers could take advantage of the cheaper rates, including access to the Skype internet phone service that allows free calls to other Skype users worldwide.

Hutchison Australia chief executive Nigel Dews said Australia's high use of the free Skype service for international calls would spur take-up of the new '3' plans.

Rival Vodafone was swift to respond to Hutchison. Within days Vodafone cut its 1GB monthly plan from $99.95 to $59.95 and introduced a $79.95-a-month 2GB plan.

Source: "3G Price Freefall", The Australian, Stuart Kennedy, 3 April 2007

3.8 FIXED-TO-MOBILE SUBSTITUTION

Telecommunications markets across a number of developed countries have observed over the past few years a trend of:

- an increasing proportion of voice calls being carried over mobile networks compared with the proportion of voice calls carried over the fixed-line networks; and
- a decrease in the number of fixed-line connections and an increase in the number of mobile connections.

The term "fixed-to-mobile substitution" (FTM substitution) has commonly been used to describe both these market developments. The two trends though involve very different types of substitution, which need to be distinguished.

Substitution in the form of an increasing proportion of traffic carried over mobile networks is driven by users opting to make calls on their mobile phones rather than their fixed-line phones. In contrast, substitution in terms of access is driven by users discontinuing their fixed-line subscription and instead using a mobile solution to meet their basic connectivity needs. To draw a distinction between the two types of FTM substitution the terminology FTM traffic substitution and FTM line substitution is adopted here.

Commentary by Northstream[13] and Analysys[14] suggests that both FTM traffic and line substitution have been accelerating throughout Europe. Northstream identifies three trends that have accelerated FTM substitution across Europe:

- increasingly mobile lifestyles demanding flexible communications;

[13] Northstream, "Fixed-to-Mobile Substitution in Europe", September 2004, available at http://www.incodewireless.com/media/whitepapers/2004/Irreversible_fixed-to-mobile_substitution_in_Europe.pdf

[14] Analysys, "Fixed-to-Mobile Substitution is Acceleration", 8 February 2007, Press Release, available at http://www.analysys.com.

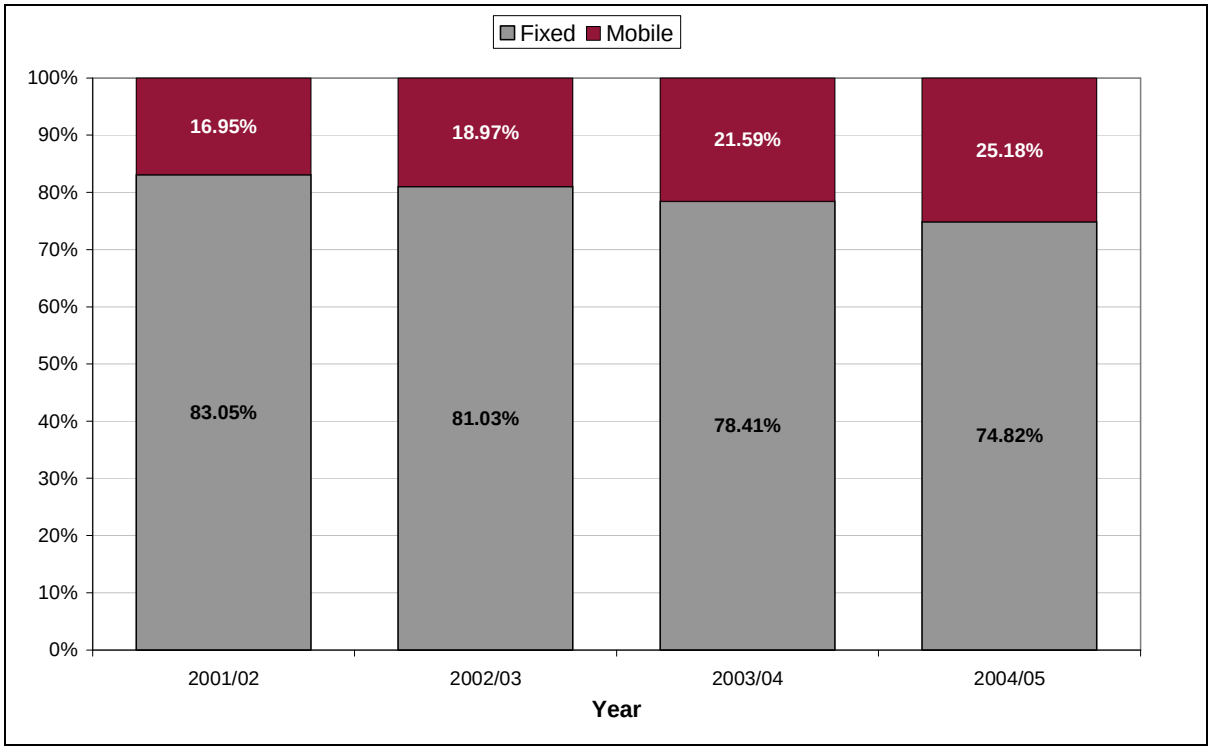
- decreasing prices for mobile services lowering the barrier for migrating traffic; and
- increased interest amongst service providers to undertake developments for FTM convergence.

Similarly, Analysys notes that users are increasingly opting for the convenience and personalisation of mobile phones even when a fixed phone is available. Their work finding that a key factor in FTM substitution in any particular country is the affordability of mobile voice calls, but that a mobile network operator can still achieve significant traffic migration even with a healthy price premium over fixed voice services.

Recent Trends in Mobile and Fixed-line Telecommunication in Australia

Using ACCC data from its *Telecommunications Market Indicator Report 2004-05*, and assuming that on average a local call lasts three minutes, Figure 3-16 shows that there has been a gradual increase in the proportionate mix of mobile voice relative to fixed-line voice calls in Australia from the 2002 to 2005 financial years.

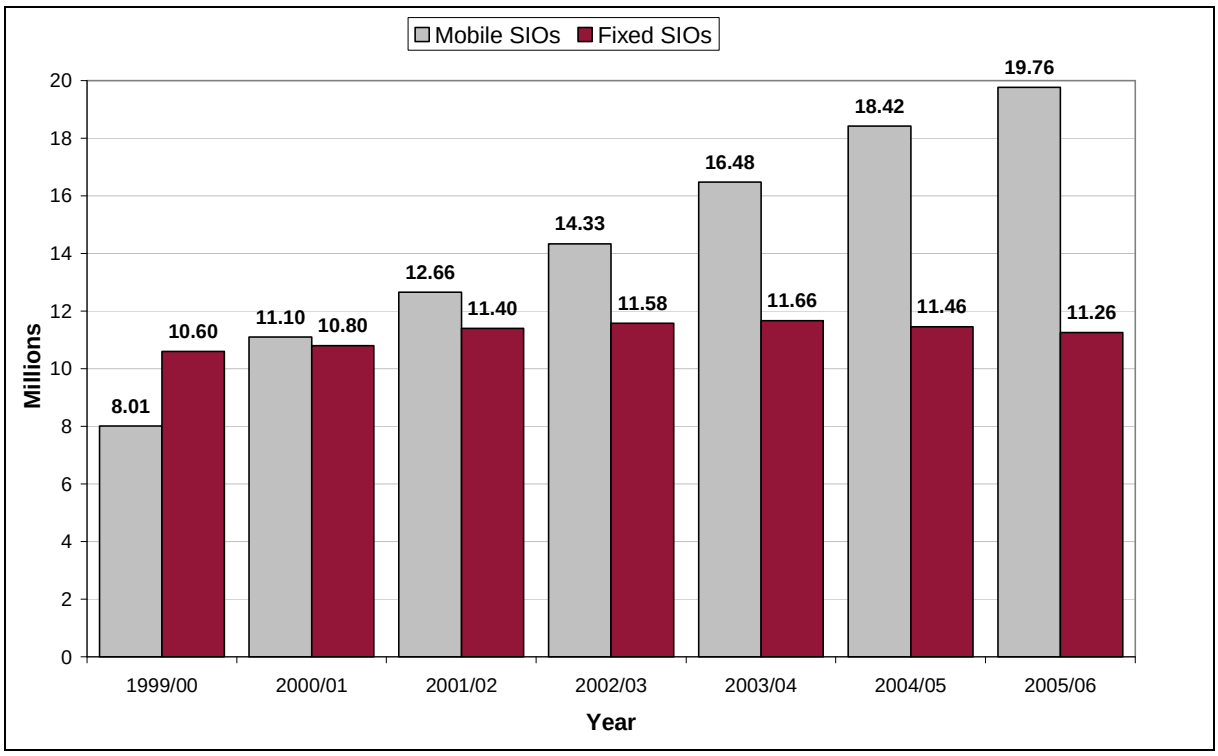
FIGURE 3-16: THE PROPORTION OF FIXED AND MOBILE VOICE MINUTES



Source: ACCC, *Telecommunications Market Indicator Report 2004-05*, July 2006.

Figure 3-17 provides data on the overall number of mobile and fixed-line SIOs in Australia from the 1999 to 2006 financial year. It illustrates that the number of mobile services exceeds the number of fixed-line services in the 2001 financial year, and that the number of fixed connections begun to decrease in 2005.

FIGURE 3-17: THE NUMBER OF FIXED AND MOBILE SIOS



Source: ACMA, *Telecommunications Performance Report 2004-05* and *2005-06*.

Ovum[15] examines similar trends in the Australian telecommunications market to those outlined in Figure 3-16 and Figure 3-17. It suggests that while both FTM traffic and line substitution have been slow in Australia compared with most European and Asia-Pacific markets, by late 2005 there had been "a clear acceleration" in FTM substitution such that Australia was "now following markets in Europe", and primed for increased FTM substitution in the future. Ovum maintain that this increased level of FTM substitution was triggered by falling mobile rates through the widespread introduction of capped mobile plans, and the increases in line rental charges for fixed-line services.

ACMA also claims that mobile capped plans and increased fixed-line rental charges have had an impact on FTM line substitution, stating on p 31 that:[16]

> *The decrease in the number of fixed-line services in Australia is largely driven by changing consumer behaviour, where consumers are substituting fixed-lines with mobile phones. Reasons for this may include mobile cap plans, increasing fixed-line rental charges, and the cancellation of phone lines that were previously used solely for dial-up internet access by consumers migrating to broadband.*
>
> *The trend to fixed–mobile substitution is demonstrated by a Newspoll survey in early 2006, which found that 40 per cent of people used mobile phones as their main point of contact. The survey also found that one in five users plan to discontinue their fixed-line telephone when they next move house and only use a mobile.*

[15] Ovum (N. Burley), "Fixed-to-Mobile Substitution in Australia", October 2005. In their analysis Ovum assumes that on average local calls last 2.5 minutes.

[16] ACMA, *Communications Services Availability in Australia Report 2005-06*, July 2007.

A survey by Roy Morgan[17] in March 2007 suggests that there has been an increasing trend of FTM traffic substitution and FTM line substitution in Australia. They outline that in March 2007, 40.2% of users of mobile phones agreed that they now used their mobile phone more than their fixed-line telephone — up from 33.2% in March 2006 and from 24.3% in March 2004 — and 22.4% of consumers were considering replacing their home phone connection with their mobile connection.

With mobile penetration reaching higher levels, capped pricing plans and a large volume of mobile-to-mobile calls, the evidence suggests that Australian consumers increasingly perceive mobile services as substitutes for traditional fixed-line voice services. This FTM substitution places competitive pressures on fixed-lined suppliers, which could arguably lead to lower prices of telecommunications services and increase benefits to consumers.

FTM Substitution — Economic Theory and Econometric Analysis

Gans, King and Wright[18] outline that in theory it is not clear whether fixed-line and mobile telephones are complements or substitutes in demand. The authors state on pp 257-8 that:

> *Are fixed-line telephones and mobiles complements or substitutes in demand? Theoretically, the answer is ambiguous. To the extent that mobile telephones offer similar call functions to fixed-line telephones, we would expect there to be substitution in demand. But mobile telephones are often used for short calls that would not be possible on a fixed-line telephone and such calls are often made to or from fixed-line telephones. Thus, the diffusion of mobile technology increases the benefits accruing to a fixed-line subscriber, potentially increasing demand for fixed-line services.*

The complementary and substitution relationship that exists between fixed and mobile services appears to be borne out in the Australian market in the data in Table 3-2. While this illustrates a decrease in the proportion of fixed voice calls (i.e. some type of FTM substitution), there has simultaneously been a trend of an increasing number of fixed-to-mobile minutes with rising mobile penetration in Australia.

TABLE 3-2 AUSTRALIAN MOBILE AND FIXED-LINE VOICE MINUTES

Minutes (millions)	2001-02	2002-03	2003-04	2004-05
Local calls*	35,505	36,204	33,537	30,456
National LD	11,702	12,157	12,133	10,999
International LD	2,280	1,460	1,294	1,158
Fixed to Mobile	4,831	5,535	5,947	6,011
Mobile	11,083	12,962	14,571	16,361
Total Minutes	**65,401**	**68,318**	**67,482**	**64,985**
% Fixed Traffic	83.05%	81.03%	78.41%	74.82%
% Mobile Traffic	16.95%	18.97%	21.59%	25.18%
Mobile (SIOs)	**12.66**	**14.33**	**16.48**	**18.42**

Source: ACCC, *Market Indicator Reports 2001-2004*, July 2006, and ACMA, *Telecommunications Performance Report 2004-05* and *2005-06*. * Note: It is assumed that local calls are on average three minutes.

[17] Roy Morgan Single Source, January 2004 - March 2007.

[18] J.S. Gans, S. P. King and J. Wright, "Wireless Communications" in the *Handbook of Telecommunications Economics Volume 2*, ed. S.K. Majumdar, I. Vogelsang and M.E. Cave., Elsevier, 2005.

Gans et al. summarise the studies examining the relationship between fixed and mobile services, and suggest that the different empirical results — i.e. a finding of substitutes versus complements — may partially be explained by differences in countries and the life-cycle of mobile technology. In particular, they note that while in lesser developed countries access to a mobile phone is likely to be a substitute for rationed access to fixed-line connections, in developed countries, the initial use of mobile telephones is likely to involve mainly mobile-to-fixed or fixed-to-mobile calls, leading to an apparent complementary relationship between the services. However, they suggest that as mobile penetration rises and mobile-to-mobile calls increase in importance, mobile phones may become substitutes for fixed-line services, and that this latter effect may be exacerbated as technology advances, which reduces the cost of mobile services and improves mobile functionality.

Gans et al. outline that while there has not been extensive econometric analysis of the relationship between fixed and mobile telephony services, the limited work that has been done suggests that there is some level of weak demand and supply substitutability between the two. For example:

- Cadima and Barros find that the availability of mobile services leads to approximately a 10% decrease in the fixed-wire telephony penetration rate;[19]
- Sung and Lee, using Korean data, estimate that a 1% increase in the number of mobile telephones results in a reduction of 0.10-0.18% in new fixed-line connections and a 0.14-0.22% increase in fixed-line disconnections; [20] and
- Koski and Kretschmer find that countries with more competition in the fixed-line markets tend to get 2G services introduced earlier.[21]

It should be noted that these studies are now slightly dated and may not reflect the relationship between fixed and mobile services at the higher penetration rates observed in a number of countries today.

[19] N. Cadima and P. Barros, "The Impact of Mobile Phone Diffusion on the Fixed-line Network", CEPR Discussion Paper 2598, London, 2000.

[20] N. Sung and Y-H. Lee, "Substitution between Mobile and Fixed Telephones in Korea", *Review of Industrial Organization*, 20, 2002, pp 367-74.

[21] H. Koski and T. Kretschmer, "Entry, Standards and Competition: Firm Strategies and the Diffusion of Mobile Technology", mimeo, London: LSE, 2002.

4. INDUSTRY ENGAGEMENT WITH GOVERNMENT

Like all major industries, the mobile telecommunications industry engages with the Australian Government in myriad ways. For example, the industry contributes to government revenues through payments for spectrum allocation as well as through annual payments such as those relating to universal service obligation (USO), the digital data service obligation (DDSO) and the National Relay Service (NRS), and carrier licences.

In addition, the evolution of the industry has been influenced and shaped by government regulation. Some of the key regulations pertaining to the Australian mobile telecommunications industry since its emergence in the 1980s are discussed in this chapter.

4.1 PAYMENTS TO GOVERNMENT

Payments made by the mobile telecommunications industry to the Australian Government include one-off payments such as spectrum licences and on-going payments such as annual spectrum access charges (encompassing the spectrum licence tax, universal service obligation and national relay service charges, numbering charges etc). Like businesses in other industries, those in the mobile telecommunications industry also pay corporate income taxes to the Australian Government and payroll taxes to State and Territory Governments.

4.1.1 SPECTRUM AUCTIONS

Radio spectrum is a natural resource, but one with some unusual properties. It is non-homogenous in that different parts of the spectrum are best used for different purposes. It is finite as only part of the electromagnetic spectrum is suitable for wireless communications. It is non-depletable — using spectrum today does not reduce the amount available for use in the future. But it is non-storable.[22]

Users of radio spectrum, particularly users of 2G and 3G mobile telephone spectrum, have generally been chosen by one of two broad approaches since the 1990s: a 'beauty contest' or an auction.

A 'beauty contest' involves potential users submitting business plans to the government or its appointed committees, with winners chosen from these submissions. There may be some payment to the government by the winners, although the potential user most willing to pay for the spectrum need not be among the winners. The UK used a beauty contest approach to assign 2G mobile telephone licences in the 1990s, while Sweden and Spain have used beauty contests to assign 3G licences. France used a beauty contest to assign four 3G licences in 2001, with pre-set criteria including employment, service offerings and speed of deployment. Winning applicants faced a relatively high licence fee by the government. Consequently, there were only two applicants.

The concept of using a market mechanism to assign property rights over spectrum originated in the 1950s, but only became a reality in the 1980s. New Zealand altered its laws to allow spectrum auctions in 1989 and used auctions to assign blocks of spectrum relating to mobile

[22] J.S. Gans, S. P. King and J. Wright, "Wireless Communications" in the *Handbook of Telecommunications Economics Volume 2*, ed. S.K. Majumdar, I. Vogelsang and M.E. Cave, Elsevier, 2005.

telephones in the early 1990s. In 2000, the UK ran the world's first 3G auction, auctioning off five 3G licences. With nine new entrants bidding strongly against the four incumbent mobile operators there was intense competition in the auction process and record-breaking revenues of €39 billion were generated.[23]

Auctions have involved a variety of formats including 'second price sealed bid' in New Zealand, modified ascending bid in the US, and a mixed ascending bid and Dutch auction format in the UK. In Australia, auction for 3G mobile spectrum licences in the 2GHz band was completed in March 2001 after 19 rounds of bidding. Successful bidders paid varying amounts for spectrum access (as can be seen in Table 4-1).

TABLE 4-1: SUCCESSFUL BIDS IN AUSTRALIAN 3G AUCTION

Company	Licence	Value ($m)
3G Investments (Australia) Pty Ltd	10 MHz paired spectrum in all capital cities	159.0
CKW Wireless Pty Ltd	5 MHz unpaired spectrum in all capital cities	9.5
Hutchison Telecommunications (Australia) Limited	15 MHz paired spectrum in Sydney and Melbourne	196.1
	10 MHz paired spectrum in Brisbane, Adelaide and Perth	
Optus Mobile Pty Lrd	10 MHz paired spectrum in all capital cities	248.9
	5 MHz paired spectrum in regional areas	
	5 MHz unpaired spectrum in Sydney, Melbourne, Brisbane, Adelaide and Perth	
Telstra 3G Spectrum Holdings Pty Ltd	15 MHz paired spectrum in all capital cities	302.0
	10 MHz paired spectrum in regional areas	
	5 MHz unpaired spectrum in all capital cities	
Vodafone Pacific Limited	10 MHz paired spectrum in all capital cities	253.6
	5 MHz paired spectrum in regional areas	
	5 MHz unpaired spectrum in all capital cities	
Total		**1,169.0**

Source: ACA 2001 (now ACMA)

4.1.2 ANNUAL PAYMENTS

The mobile telecommunications industry is required to make a number of industry-specific payments to government. Access Economics estimates that, in 2005-06, the estimated value of these payments was $176.1 million (see Table 4-2). This was equivalent to about 1.3% of total industry revenue.

Carriers are required to contribute to the cost of providing universal service obligation (USO), the digital data service obligation (DDSO) and the National Relay Service (NRS), and are also required to pay carrier licence fees. Many of these payments are proportional to a carrier's eligible revenue, which is based on the carrier's gross sales revenue less a series of revenue and expense deductions.

[23] P. Klemperer, "How (Not) to Run Auctions: The European 3G Telecoms Auctions", in *Spectrum Auctions and Competition in Telecommunications*, ed. G. Illing and U. Klüh, MIT Press, Cambridge, 2003.

In addition, the industry contributes to its effective operation through voluntary and compulsory payments to support various industry associations and self-regulatory schemes, including AMTA and the Telecommunications Industry Ombudsman (TIO).

TABLE 4-2: ANNUAL PAYMENTS TO GOVERNMENT, 2005-06

Payment type	Basis for calculating payment amount	Estimated 2005-06 payment ($ million)
Radiocommunications licence fee		61.3
Universal Service Obligation	Eligible telecommunications revenue	54.6
National Relay Service	Eligible telecommunications revenue	2.0
Licence fee for fixed service	Number of fixed point-to-point installations	9.6
Numbering charge	Quantity of mobile telephone numbers	38.2
Annual Carrier Licence Charge	Fixed sum plus eligible telecommunications revenue	9.7
Health Research Levy	Radiocommunications licence fee	0.6
Total		**176.1**

Source: Access Economics calculations based on data in *ACMA Communications Report 2005-06*

Note: For payments that are contingent on eligible telecommunications revenues, the 2005-06 figures were computed by applying the share of mobile payments in the 2004-05 figures to the total payments made by the telecommunications industry in 2005-06 and adjusting for the rise in the share of mobile telecommunications revenues in total telecommunications revenues between 2004-05 and 2005-06. Licence fees for fixed services were estimated by assuming that the growth rate for such fees were the same in 2005-06 as in 2004-05.

4.2 INDUSTRY REGULATION

Since its origins in the 1980s, the mobile telecommunications industry has been subject to regulation by various Government bodies and agencies. This section discusses the history of regulation in the industry, key regulatory issues facing the industry, and examines recent regulatory developments in Europe pertaining to mobile telecommunications. European countries have been leaders in mobile technology and mobile penetration, and regulatory changes in Europe have often been a pre-cursor to similar developments in Australia.

4.2.1 BRIEF HISTORY OF INDUSTRY REGULATION AND LEGISLATION

For the most part of the 20th century, Australia's general telecommunications industry was dominated by various centralised, publicly-controlled monopoly structures. These were thought to be natural monopolies due to scale economies, and were protected from competition by legislation.

The Australian Government moved towards industry liberalisation in the late 1980s with various reforms implemented under the *Telecommunications Act 1989*. The subsequent passing of the *Telecommunications Act 1991* enabled the introduction of limited infrastructure competition and the full resale of telecommunication services, as a transitional step towards open competition. This included the issuance of two additional licences to Optus (a national carrier) and Vodafone (a mobile-only carrier), thus establishing a three carrier structure in the Australian mobile market.

The Purpose of Recurring Charges

Annual Spectrum Licence Tax

The Australian Communications and Media Authority (ACMA) recovers a share of the overhead costs of maintaining spectrum through an annual fee or 'spectrum licence tax' on all licensees. Spectrum licensing fees are calculated by adjusting the base amount paid for the spectrum according to its geographical area and the proportion of the population included in that area.

Universal Service Obligation

Universal service arrangements aim to give residents in sparsely populated areas of Australia access to standard telecommunications services at a price comparable to those available to the rest of the population. This is achieved via a cross-subsidisation arrangement that is funded by a USO levy on all telecommunications carriers (both fixed and mobile).

National Relay Service

The National Relay Service (NRS) allows people who are deaf or have a hearing or speech impairment to use the telephone, and is available to all consumers at no additional cost. Telecommunications carriers are required to contribute to the cost of the NRS.

Fixed Services Licence Fees

Mobile network operators are required to have licences for fixed services issued by ACMA. The licences authorise licensees to operate radiocommunications devices such as transmitters and receivers. In effect, they are licences to use specific segments of the radiofrequency spectrum for particular purposes.

Numbering Charges

Numbering charges are collected by ACMA in accordance with a statutory 'numbering plan'. According to the plan, carriage service providers are liable for all charges relating to the numbers they hold on a pre-determined census date.

Annual Carrier Licence Charge

Each licensed carrier is required to pay the Annual Carrier Licence Charge (ACLC). Revenue generated from this charge is used to operate the various telecommunications regulatory bodies.

Research Levy

Since 1996, each radiocommunications apparatus licence fee has included an additional 1% to fund research and public education into the possible health impacts of mobile phone use.

The research sponsored by the levy is conducted through the independent National Health and Medical Research Council (NHMRC) in the Australian Government's Health and Ageing portfolio. Moreover, it is part of an international research effort facilitated by the World Health Organisation (WHO) Research Coordination Committee, which is monitoring a broad ranging series of scientific studies into electromagnetic field exposure.

In July 1997, the introduction of the *Telecommunications Act 1997* established open competition in the Australian telecommunications industry and a regulatory framework based on a series of industry codes (developed by the industry itself), industry standards (determined by the ACA, now ACMA) and technical standards governing customer equipment such as networks and cables.

The Act allowed for increased industry self-regulation, especially in areas such as access, interconnection standards, technical standards as well as consumer and customer service standards.

There are currently 19 industry codes governing the operations of the telecommunications industry. Of particular relevance to the mobile telecommunications segment are the Mobile Number Portability (MNP) Code (which was re-registered in August 2002), the Deployment of Radiocommunications Infrastructure Code (registered in October 2002) and the Short Message Service Code (registered in July 2003). The MNP code was revised in early 2004. This required the industry to process 99% of customer requests to retain their existing number when changing telecommunications carriers within two business days, and 90% within three standard hours of operation.

The *Radiocommunications Act 1992* and the *Trade Practices Act 1974* also form the basis of the industry's regulatory structure. As part of the 1997 reforms, telecommunications-specific anti-competitive conduct and access regulation were introduced under Parts XIB and XIC of the Trade Practices Act.

4.2.2 KEY REGULATIONS

Key regulatory issues concerning mobile telecommunications services in Australia include: the Universal Service Obligation; the declaration of services; mobile terminating access service rates; mobile number portability; content services; and security-related or law enforcement issues.

Universal Service Obligations

A historical cornerstone of the Australian telecommunications framework has been the Universal Service Obligation (USO) who has been defined as "the obligation placed upon the universal service provider to ensure that defined telecommunications services are reasonable accessible to all people in Australia on an equitable basis, wherever they reside or carry on business".

The USO payment is ultimately a payment to Telstra by others in the industry via the government for the provision of fixed services. On 27 June 2007, the Minister for Communications, Information Technology and the Arts announced a review of the USO.

Declaration of Services

Under the Trade Practices Amendment (Telecommunications) Act 1997, carriage services can be 'declared', whereupon carriage service providers supplying these services are obligated to supply the services to requesting service providers. A service, once declared, is essentially under the control of the regulatory framework.

An example of a declared service in mobiles is the wholesale mobile terminating access service — the payment made by one carrier to have a call connected to another carrier's

mobile network. For instance, if an Optus subscriber calls a Telstra subscriber, Optus must pay Telstra for the right to connect or terminate the call on Telstra's network.

Further information on the regulation of mobile termination is available in the discussion that follows.

Mobile Termination Rates

The ACCC declared the mobile terminating access service (MTAS) in 1997. The pricing principles that the ACCC released in July 2001 involved relatively light-handed regulation of the declared MTAS. This established that the price of the service should decrease in line with the average price for a bundle of mobile retail services.

In late April 2003, the ACCC commenced its mobile services review, with the release of a discussion paper examining the extent and need for regulation within the industry, and whether such regulations are appropriate under the Trade Practices Act. An area examined was whether there was a need for continued regulation of the wholesale mobile termination and origination services, as the expiry date for the declaration of the domestic GSM and CDMA terminating access service was 30 June 2004.[24]

The ACCC found that between 2001 and 2003, the price of the retail bundle did not decline as much as anticipated. The ACCC suggested that the marketplace was not ensuring that the MTAS price was adjusting towards cost. Consequently, it moved towards a more direct mechanism to regulating mobile termination rates to ensure a closer association between the MTAS price and what it believed to be the underlying production cost. The ACCC considered that the total service long-run incremental cost with a mark-up to cover common network costs was the appropriate measure of costs towards which the price of the MTAS should trend.[25]

Using 21 cents per minute as the initial rate for 1 July 2004, a level the ACCC determined to be the lowest price available in the market, the ACCC proposed an indicative price for the MTAS that involved a steady three cent per minute decline on 1 January over each of the following three years (see Table 4-3).

TABLE 4-3: AUSTRALIAN MOBILE TERMINATION RATE, 2004 TO 2007

Time period	Rate (cents per minute)
1 July 2004 – 31 December 2004	21.0
1 January 2005 – 31 December 2005	18.0
1 January 2006 – 31 December 2006	15.0
1 January 2007 – 30 June 2007	12.0

Source: ACCC, *Mobile Services Review — Mobile Terminating Access* Service, Final Report, June 2004

While commercial negotiation between carriers could determine termination rates, in practice carriers have been unable to reach agreement as changes in termination rates affect carriers differently, depending on the volume of ingoing and outgoing calls. The ACCC has thus been required to arbitrate and has enforced the indicative prices outlined in the table above. Optus'

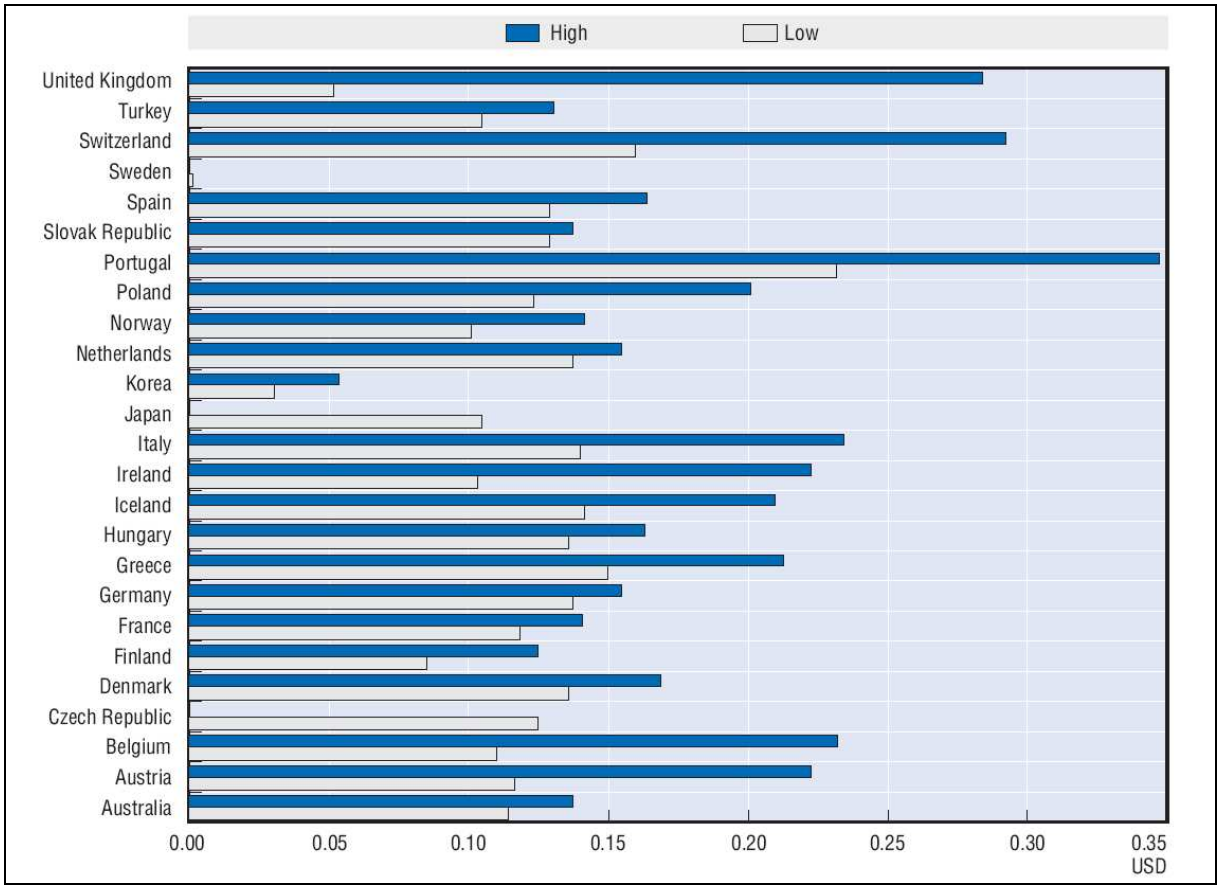
[24] ACCC*, Mobile Services Review — Discussion Paper*, April 2003.

[25] ACCC, *Mobile Services Review — Mobile Terminating Access* Service, Final Report, June 2004, p xviii.

and Vodafone's appeals of the ACCC's decision to the Australian Competition Tribunal (in late 2006 and early 2007 respectively) were unsuccessful.

The ACCC has recently issued a draft determination on pricing principles for the period from 1 July 2007 to 31 December 2007, proposing a further reduction in the indicative MTAS rate to 9 cents per minute. Figure 4-1 compares Australia's wholesale fixed-to-mobile termination rates in 2006 in US dollars per minute against those of other OECD countries.

FIGURE 4-1: OECD COMPARISON OF PER MINUTE PRICES FOR FIXED-TO-MOBILE TERMINATION RATES, 2006 (USD)



Source: *OECD Communications Outlook 2007*, p 31

Regarding mobile origination across services, the ACCC has decided to cease regulation in this area on the grounds that continued regulation would be detrimental to the long-term interests of end users. The ACCC is also to determine if domestic and international roaming services (which are presently unregulated) should be subject to some form of regulation.

Mobile Number Portability

Number portability is the ability of customers to retain their existing telephone number when switching from one service provider to another. Several provisions for number portability were made in the *Telecommunications Act 1997* and the *Telecommunications Numbering Plan 1997*. From 25 September 2001 on, all Australian mobile carriage service providers were required to make available mobile number portability (MNP). The agreed industry code requires carriers to transfer 90% of the numbers to be ported within a two hour 50 minute deadline (compared to three days in Hong Kong and up to 25 days in the UK).

It was initially expected that the introduction of MNP would intensify already high competition levels and increase customer churn (as had occurred in Hong Kong, where churn rates doubled). However, the effects of MNP were more subdued than anticipated. According to the Australian Communications Authority (now ACMA), less than 1% of the mobile subscriber customer base changed their mobile phone company in the two months following the introduction of MNP.

Spectrum

ACMA plans and manages the radiofrequency spectrum in Australia. The scope of ACMA's role includes spectrum planning, apparatus licensing, radiofrequency class licensing, spectrum licensing, auctions and trading, satellite communications and space systems regulation and international radiocommunications activities.

In December 2006, ACMA issued a discussion paper for public comments entitled "Strategies for Wireless Access Services: Spectrum Access Options." The purpose of the paper is to provide information regarding a number of issues, such as demand for wireless access services (WAS), as well as an overview of the responses received to an earlier discussion paper "Strategies for Wireless Access Services". The new paper also serves to identify frequency bands that ACMA believes are currently the most suitable candidates for WAS in the short, medium and long term.

Content Services[26]

The Australian Government is committed to enacting legislation to safeguard Australians, particularly children and their families, from accessing offensive or harmful content delivered over mobile phones.

AMTA has supported this policy objective and has been at the forefront of what has proved to be an effective form of regulation — the co-regulatory regime.

The industry provided substantial input to the recent Content Services Legislation to ensure it had practical industry feedback, and that it took into account the industry's Mobile Premium Services Industry Scheme. This Scheme is aimed at providing robust consumer safeguards and standards, and covers all aspects of mobile premium services ranging from, the assessment of content, complaints handling, take-down arrangements and compliance plans. In particular, it provides safeguards to protect children, gives consumers clear cost information on premium mobile services and provides for a "stop" command to unsubscribe from services.

Emerging technology presents new challenges for industry and regulators to ensure that service delivery meets community standards and expectations for responsibility and accountability. AMTA will be working closely with ACMA over the coming months to implement the Content Services legislation and ensure that the industry's operational needs are aligned with the legislation's requirements.

[26] Information on Content Services and Law Enforcement were provided by AMTA.

Industry Desire for Streamlined Regulations

In its submission to the current Productivity Commission Inquiry into the Australian consumer policy framework, AMTA supported the Commission's view on good practice regulation. Good practice regulation must have a sound rationale and be shown to bring net benefit to society after taking into account all costs and benefits.

AMTA believes that there should only be regulatory intervention when market failure has clearly been demonstrated. Other important principles include:

- Technology neutrality: government should ensure that obligations do not inadvertently favour or hinder one form of technology over another, and are consistent and comparable with those imposed on comparable services and industry
- Competitive neutrality: obligations and enforcement should apply equally, or at least equitably, to all service providers
- Provide incentives to invest or at least no disincentive to investment. That is, consumer policy (particularly in relation to accessibility and affordability by disadvantaged and vulnerable consumers and affordability by disadvantaged and vulnerable consumers) should empower and resource consumers to purchase their preferred solutions with in the marketplace rather than placing the cost of supply on only one industry or one service provider and
- The principle that regulation in Australia should be consistent with regulation applied to Australia's major trading partners and in comparable economies.

AMTA's submission maintained that, where possible, governments should promote industry self-regulation and that any co-regulation should attempt to avoid delegated legislation overlap and inconsistency between jurisdictional and agency responsibilities. The submission also suggests that policy development should be the responsibility of policy departments rather than the regulator.

Source: AMTA, *Submission to the Productivity Commission's Review of Australia's Consumer Policy Framework*, http://www.pc.gov.au/inquiry/consumer/subs/sub033.pdf

Law Enforcement

The mobile telecommunications industry is working closely with governments on national security issues. It recognises its responsibility in working with law enforcement agencies to assist them in pursuing objectives to safeguard the community from security threats and help in the protections of citizens.

In particular the mobile telecommunications industry:

- has recognised the ongoing changes in technology and industry structure mean that the interception regime will require adjustments from time to time;
- has sought to achieve a balanced policy outcome on issues of national security that maintain the competitiveness of the Australian telecommunications industry and the uptake of new technologies, innovation and the launch of new customer services.
- has acknowledged the challenge facing governments in developing policy that balances the interests of law enforcement agencies, consumers and the industry in a timely manner; and
- is liaising with law enforcement agencies and the Australian Government to help ensure that the impact of legislation on the industry is commensurate with the risk it seeks to address and measures adopted are balanced, practical and cost-effective.

To further enhance the industry's working relationship with the Attorney-General's Department and other law enforcement agencies, the industry has proposed the formation of new forums to facilitate and streamline policy discussions between industry, the Department and law enforcement agencies.

AMTA and its members are currently working with governments on a diverse number of national security-related issues, such as pre-paid identity checks, data retention, jamming, bomb disposal and anti-money laundering. AMTA is also developing a common pre-paid identity check form for use at the point-of-sale. Such information is required by law and the new, universally applicable forms will streamline the supply of this important information.

4.2.3 DEVELOPMENTS IN EUROPEAN MOBILE REGULATION

The European Union and the national regulatory bodies of various European countries are frequently seen as global leaders in telecommunications regulations. In the past, Australian regulation has in various instances occurred several years after similar action was taken in Europe, an example being mobile termination rates. It is therefore instructive to examine the latest developments in European mobile telecommunications regulations, as they may be indicative of future regulatory changes in Australia.

Spectrum Liberalisation

Spectrum liberalisation has been one of the key issues in European mobile regulation for a number of years. The core underlying idea is that markets, rather than regulators, are better placed to decide on the most efficient use of spectrum.

Implementing liberalisation poses significant challenges. These are

- technical – ensuring that liberalisation does not create unacceptable degrees of interference or disputes between users;
- economic – balancing the benefits of liberalisation against the interests and expectations of operators and equipment manufacturers who have made large investments under the old regime; and
- legal – some bands are allocated either by international agreement or by the EC to particular technologies and services.

According to Nick Pimlott, solicitor in the Communications Group at Field Fisher Waterhouse LLP, key developments in spectrum liberalisation in 2007 will be[27]:

- Major consultations by Ofcom (the UK telecommunications regulatory body) and the European Commission on what to do with the spectrum released as part of the switchover to digital television between 2008 and 2012 (the "Digital Dividend").
  - In the UK digital switchover is expected to release 112 MHz of spectrum in the so-called "sweetspot" between 200 MHz and 1 GHz.
  - There are a large number of potential uses of this spectrum and Ofcom, in line with policy of liberalisation, is not proposing to choose between them but rather to release the spectrum by way of auction on a technology- and service-neutral basis.

[27] See "Mobile Regulation", 31 January 2007, available at http://www.mobileeurope.co.uk/features/112519/Mobile_regulation.html.

- It has recently launched a consultation on how the spectrum should be packaged and on auction design with the first auctions anticipated in the second half of 2008.
- The European Commission, consistent with the proposals in its Review of the EU Regulatory Framework for Electronic Communications Networks and Services in June 2006, can be expected to adopt a similar approach.

- Further development of the notion of "spectrum usage rights" which Ofcom issued a consultation on in April 2006.
  - One of the challenges of liberalising use of the spectrum is ensuring that interference environment is not materially impaired.
  - Ofcom's proposals for spectrum usage rights would seek to define permitted emission levels at frequency and geographic boundaries.
- Liberalisation of 2G mobile licences may become a reality in 2007 enabling 2G mobile operators to use 3G technologies in the GSM spectrum.
  - This has been held up by legal difficulties – the GSM Directive mandates GSM technology in the 900 MHz mobile spectrum, but moves are afoot to amend this.
  - The difficult question of whether 2G operators should pay for these valuable additional rights and, if so, how, will also need to be confronted.

Data Termination

In 2006 the European Commission proposed including SMS termination in the market for mobile termination in its draft recommendation on relevant product and service markets within the electronic communications sector.[28] Further, in July 2006, the European Commission endorsed the decision by the French national regulatory authority, ARCEP ('l'Autorité de Régulation des communications électroniques) to regulate wholesale SMS termination charges for Orange, SFR, and Bouygues being endorsed by the European Commission in July 2006.[29] Ofcom has also recently announced a review of the wholesale SMS termination market.[30]

Roaming

The usage of roaming has been relatively low among European citizens and especially for occasional travellers. At present, only a minority of all mobile customers makes use of roaming services despite overall EU mobile penetration of above 100%.

In recent years, there has been growing concern that consumer prices for European Union (EU)-wide roaming are not justified by the underlying costs of providing the service. High prices have been the subject of complaints by national regulatory authorities, the European Parliament, consumer groups and users of mobile services. Threats of regulatory action have led to token actions by service providers to lower roaming prices. In view of its cross-border

[28] Analysys, "The European Commission's draft recommendation will have a wide-ranging impact on the electronic communications sector", Press Release, 30 June 2006.

[29] See "ARCEP adopts its decision on SMS call termination in Metropolitan France following a favourable opinion from the European Commission", ARCEP Press Release, 27 July 2006.

[30] See "Wholesale SMS Termination Market Review", 13 September 2006, at http://www.ofcom.org.uk/telecoms/ioi/mbp/smsreview/

dimension, the national regulatory authorities indicated that the problem could not be addressed using existing regulatory tools.[31]

It was noted that:

- retail charges for roaming were very high without clear justification;
- this appeared to result both from high wholesale charges levied by the foreign host network operator and also, in many cases, from high retail mark-ups charged by the customer's own network operator;
- reductions in wholesale charges were often not passed through to the retail customer;
- customers often lacked clear information on the charges for roaming; and
- there were strong linkages between the markets in the different member EU states.

On 23 May 2007, roaming regulation was approved by the European Parliament. The proposed regulation would ensure that people who normally avoided using their mobile phone abroad would now be able to experience more benefits of mobile communications.

The following benefits are expected when the roaming regulation is implemented[32]:

- Prices paid for international roaming when travelling within the EU will not be unjustifiably higher than the charges for calls paid within the user's country.
- Consumers will benefit from lower prices for making calls in the visited country, back home or to any other EU Member State.
- Consumers will make considerable savings when receiving calls.
- Prices operators charge each other (wholesale charges) will be considerably lower than what they are today. This ensures all operators will be in a position to offer lower retail tariffs.
- Transparency of roaming charges for consumers will be enhanced. Mobile operators will be required to provide customers with full information on applicable roaming charges when subscriptions are taken out and to update consumers regularly about these charges. Consumers can ask for information on roaming charges free of charge either via SMS or voice call.

It is expected that EU consumers will be paying around €4.4 billion less per year for their calls abroad.

[31] European Commission, "Impact Assessment of Policy Options in Relation to a Commission Proposal for a Regulation of the European Parliament and of the Council on Roaming on Public Mobile Networks Within the Community", Commission Staff Working Paper, July 2006.

[32] See http://ec.europa.eu/information_society/activities/roaming/roaming_regulation/index_en.htm

5. PRODUCTIVITY, INNOVATION AND INVESTMENT

The mobile telecommunications industry is characterised by rapid technological and service innovations as well as costly, large-scale infrastructure (and other) investments. This chapter describes some of the latest innovations in, and investments undertaken by, the Australian mobile telecommunications industry. These discussions are prefaced by a review of recent evidence on the link between mobile telecommunications and labour productivity.

5.1 PRODUCTIVITY GAINS ENABLED BY MOBILE TELECOMMUNICATIONS

Anecdotal evidence suggests that mobile telephony has benefited business by allowing for small slivers of time to be made productive and for people to remain up-to-date with news and developments on projects in the work place, whilst out of the office and on the move. For example, IDC notes that responding to email is taking up an increasing amount of corporate user's time, so being able to use mobile devices to respond to email when out of the office allows employees to be more time efficient and better at utilising gaps in their daily work schedule.[33]

There have been numerous case studies or examples of the impact that mobile telephony has on productivity of a particular business or firm. For example:

- Dural First National, a real estate agency with more than 3000 agents across Sydney, found that since using 3G phones running Loc3 — the first location-based mobile data service for the real estate industry — sales agents have saved at least two hours per day and become around 25 per cent more efficient. The technology does this by enabling agents to download, enter and send data at high-speed in the field and generate reports;[34]
- Leapfrog IT — a Perth-based payment system provider with 15 staff and a sales force of about 65 in Australia and New Zealand providing non-banking payment products such as loyalty cards and smartcards — maintains that it was able to boost the productivity of its staff by up to two hours a day since introducing PDA-style phones;[35]
- A case study by BlackBerry of the North American Transport Company, Robert Transport — the second largest transportation company in Quebec, Canada — claims that the introduction of the BlackBerry in 2002 improved the efficient operations of the company. Amongst other things it allowed for: a more efficient and up-to-date billing system; improved communications with drivers; online tracking systems to check delivery status; and a productivity gain for dispatch teams of two hours per day. In 2004, Robert Transport won the Shipper's Choice Award and was voted as one of the Top 50 Best Managed Companies in Canada;[36] and

[33] IDC, *Corporate Mobile Email in Western Europe 2004-2009*, September 2005.

[34] AMTA, *Third Generation Mobile Networks in Australia — Broadband for your Mobile Phone*, An Information Booklet, 2005.

[35] "Cutting Wires Slashes Costs", The Australian, Jennifer Foreshew, 8 May 2007.

[36] See Blackberry, *BlackBerry Supports Customer and Sales Efforts for Forward-thinking Transport Company*, available at http://www.blackberry.com/products/pdfs/robert_cs.pdf

- Nokia outline that the Nokia-IBM mobile information system has raised the productivity of Ricoh France's field technicians by 15%, because it allows employees to manage their schedules whilst out in the field, and the in-house technical staff's productivity by 40%, because they no longer have to take calls from field technicians requesting information.[37]

While there appears to be a number of individual case studies of the productivity impact that mobiles have on business, there has been a paucity of studies examining the overall impact that mobiles have made to business productivity throughout the economy.

One study for the OECD by the Research Institute of the Finnish Economy (ETLA) in 2004, found that mobile communication increased employee productivity by 25% irrespective of industry, resulting in a 6% overall increase in business productivity.[38]

A more recent study is that conducted by the Centre for Economics and Business Research (CEBR), on behalf of the United Kingdom (UK) mobile provider O_2 (now part of Telefonica). This report drew together research from a wide range of sources and an interview program of mobile users and mobile-using businesses. It assessed the overall contribution that the use of mobile made to labour productivity in the UK,[39] and some of their key findings are discussed below.

Findings of CEBR on the Productivity Impact of Mobiles on the UK Economy

In the UK, mobiles' share of business investment in communication increased from 27% in 2000 to 42% in 2004. It is estimated that 27% of the UK workforce are mobile workers. Most of these are blue-collar workers without a permanent business location. (Most previous studies have focused on knowledge or white-collar workers.)

The average UK worker spends only 1% of his or her work time travelling on business every year (not including time spent in meetings or working off-site). Those interviewed spent around five times this amount travelling for work. 62% of those interviewed believed their mobile phone to be an essential business tool.

Overall, the CEBR estimated that mobile workers spend a third of their time out of their office travelling, at meetings, working off-site or at home. Mobile workers use their phones for:

- making closer contact with colleagues;
- planning their schedule on the move;
- making important calls to customers or suppliers during travel time;
- catching up with other developments back at their base; and
- having 'a quick chat' to reassure clients and build and reinforce business networks.

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[37] Nokia, *The Myths of Mobility: Debunking the Common Misperceptions Surrounding Workforce Mobility*, Nokia Whitepaper, December 2005, available at http://www.nokia.com/nokia/0,8764,330,00.html

[38] This information is taken from Northstream, "Fixed-to-Mobile Substitution in Europe", September 2004, p 3, available at http://www.incodewireless.com/media/whitepapers/2004/Irreversible_fixed-to-mobile_substitution_in_Europe.pdf

[39] Centre for Economics and Business Research (CEBR), *"I Can't Imagine Working Without My Mobile" – An Analysis of How Mobile Phone Use Contributes to Business Productivity*, A Paper Commissioned by O_2, December 2005, available at http://www.O2.com/media_files/CEBR4.pdf

Productivity and Social Impacts of Mobile Phones

In the first Australian study specifically undertaken to assess the social impact of mobile phones at home and work, a third of workers say it would be difficult to their job properly without their mobile phone – this is particularly the case for men.

Half of employed respondents think that mobiles increase their workload, for 42% the effect is neutral and a few (9%) think mobile reduce their workloads. This is offset by productivity gains. Over half (55%) of employed respondents indicate that job-related mobile calls increase their productivity.

Some of Australia's leading social researchers from the Australian National University, the University of New England and the University of New South Wales found that only 3% of respondents reported that the mobile phone had a negative impact on their work-life balance. More than half of respondents believe that they have helped to balance their family and working lives.

The project is a collaboration between university-based researchers and AMTA, under the umbrella of the Australian Research Council Linkage grant scheme. It collected nationally representative data in March to May 2007 from a sample of 1358 individuals from 845 on-line households.

The preliminary results of the first phase of the three-year project found that the mobile phone is an indispensable part of the everyday life of Australians with more than 90% of respondents reporting that their lives could not "proceed as normal" if they were suddenly without their mobile phone.

"Contrary to fears about the intrusive character of the mobile phone on leisure, few respondents (4%) report that the mobile reduces the quality of their leisure time," the preliminary report says.

The researchers said the findings had the potential to influence the type and range of wireless services that would best serve Australians in the future.

Other key findings of the research are:

- Logs of actual calls made and SMS texts sent show that the predominant use of the mobile is contacting family and friends with work-related reasons far less important. Men make more calls for business purposes while women use the mobile for social connectivity.
- Conveying information about "timing of the arrival at home" and "arranging to meet with other family members" are the major uses of the mobile phone for micro-cordination. Among parents, "arranging to deliver goods or children" and "finding out where children are" is rated as important.
- Carrying a mobile phone makes most people (75%) feel more secure.
- Most people (59%) find the mobile phone does not affect their level of stress. Of those who report that it does, respondents are three times more likely to say it reduces stress levels.
- Contrary to fears about the intrusive character of the mobile phone on leisure, few respondents (4%) report that the mobile reduces the quality of their leisure time.

Calls made on the mobile phone were mostly made for social or leisure purposes (32%) or for managing home and family (29%). Other interpersonal contacts account for 15% of the reasons for making calls and only 24% of calls were related to work or study.

There are marked differences between men and women in the purposes for which calls are made. Over a third of men (38%) use their mobiles to make calls for work/study activities compared to only 11% of women. Text messages are even more socially oriented with only 15% of men and 5% of women texting in relation to work/study.

Source: AMTA, 2007

The largest benefit from mobile phones is closer contact with clients and faster supply chains speeding up the entire business process.

The CEBR estimated that around 16% of ICT-led growth in the UK has been due to communications from the beginning of the 1980s. Using the fact that mobiles accounted for 42% of business investment in communications in 2004 and making the assumption that mobiles' share of communications equipment-led productivity benefits equals mobiles' share of communication spending, CEBR calculated that having more mobiles saved UK workers around 320 million working hours in 2005.

Next, assuming that mobiles' share of total factor productivity (TFP) growth is equal to its share in capital deepening (2.6% in 2004) increases the estimate of the number of hours saved annually by UK workers by 140 million to 460 million.

In the aggregate, the CEBR estimated that mobiles increase UK labour productivity by just under 1%. Because of mobiles, UK workers can all work for around 20 minutes less each week to achieve the same output. From another perspective, if all mobile workers were able to use 5% more of their time out of the office productively, this would be the equivalent of an extra 180 million hours of work each year. This is around one-third of the total productivity impact CEBR estimated from mobiles.

In total, the CEBR estimated on behalf of O_2 that the productivity benefits of mobile phones boosted UK GDP by £8.9 billion in 2004.

5.2 INNOVATION

This section looks at the new networks delivering convergence between the traditional fixed-line and mobile telephone and Internet networks. The deployment of these networks has begun worldwide, and the industry has developed the Next Generation Network (NGN) concept to cover the advancements. NGNs promise to bring about a major transformation in the way people and businesses communicate and interact, and offer a significant expansion.

Before outlining what the NGN delivers, it is necessary to contrast the traditional telephony and Internet networks.

5.2.1 TRADITIONAL TELEPHONY NETWORKS VERSUS THE INTERNET

The traditional fixed and mobile telephone networks were "connection oriented" and designed to handle one-to-one voice communications in a technically efficient manner while providing a high quality of service and reliability. The basic architecture assumed the intelligence resided within the network and was controlled by the operator of the network. End user equipment had limited functionality, leading to the description that the telephone network involved "smart networks with dumb terminals".

In contrast, the Internet network is not defined by a standardised architecture, and is a collection of inter-working networks using a common set of protocols. The Internet is

therefore considered "connectionless" and based on packet switching technologies using protocols referred to as the Internet Protocol (IP) suite. Information is sent in a sequence of separately routed packets able to contain data, image or video. Some packets may be delayed or lost in transit, and it is the responsibility of user equipment rather than the network to initiate re-transmission of lost information. Unlike the traditional telephone networks, the Internet is a "best effort" network with no guarantee of quality of service. The logic or intelligence end-to-end across the network is outside the control of each network operator, leading to the description that the Internet network is a "dumb network with smart terminals".

The NGN concept requires the bridging of both approaches to support the services provided by both the traditional telephone and emerging internet networks, and new NGN services that are still to be defined.

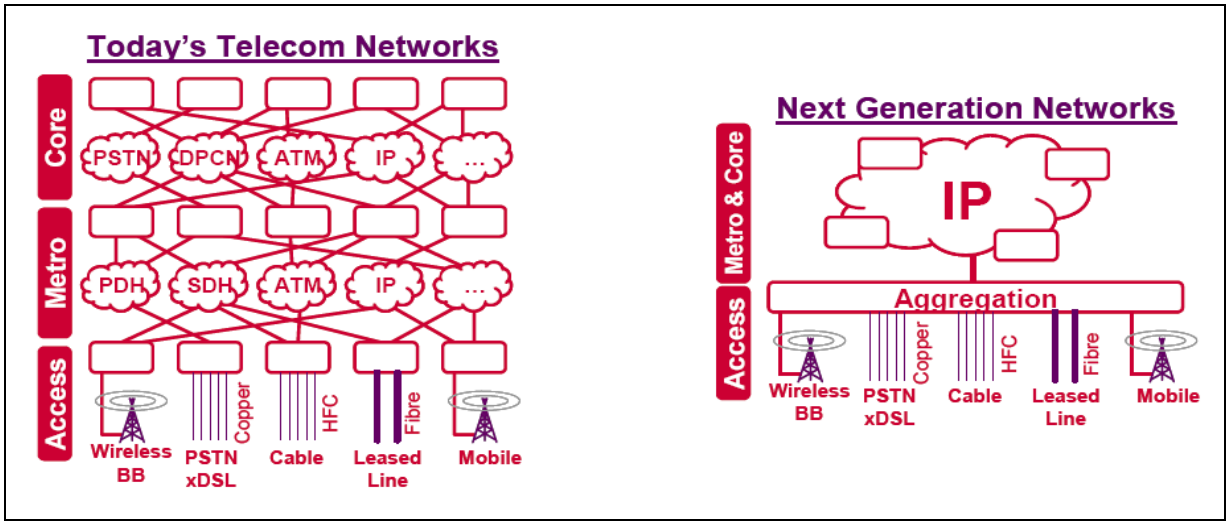
5.2.2 THE NGN

The NGN is a broad term to describe several architectural evolutions currently underway in the telecommunication core and access networks. The general idea behind the NGN is that one network transports all information and services (voice, data, and multimedia) by encapsulating these into packets, as on the Internet. The two major components of any NGN are likely to be:

- an IP-based core network with enhancements to support not only the standard Internet-based services with Internet grade quality, but also Quality of Service (QoS)-based applications and real-time services; and
- broadband customer access network with support for both and mobile services.

The resulting simplified network structure, where a single next generation IP-based core network carries traffic from all access sources is illustrated in Figure 5-1.

FIGURE 5-1: COMPARISON OF TODAY'S NETWORKS AND NGNS



Source: Ofcom, *Next Generation Networks: Further Consultation*, August 2005, p 8

NGNs deliver convergence between the traditional telephony networks and new data networks by carrying a full range of multimedia services on a common broadband digital connection to consumers. Further, the access-agnostic nature of the NGN, where 3G mobile telephony, optical fibre, cable and fixed wireless are viewed as alternative means of accessing the IP core network, has implications for fixed-to-mobile convergence. In

particular, a number of carriers have begun to offer converged devices that use the mobile network away from home, and the user's broadband link when at home to offer VoIP services.

The OECD noted on p 97 of its *Communications Outlook 2007* publication that:

> *The line between fixed and mobile calls is blurring. Previous OECD Communications Outlooks have separated access paths by technology. However, the emergence of converged devices may necessitate a change in how telephone access paths are counted. For example, several fixed-line operators in the OECD area have introduced devices that place calls over the user's fixed line when the user is at home and over a mobile network when they are away. KT in Korea, BT in the United Kingdom, and Orange in France have launched phones that use the mobile network when away from home but can connect to the user's broadband connection via Bluetooth or Wi-Fi at home to place calls at fixed rates. KT's "OnePhone", BT's "Fusion" and Orange's "unik" networks allow users to roam seamlessly between a mobile network and the Bluetooth connection without disrupting an ongoing call.*
>
> *All three services are limited to fixed line calling at the user's home and mobile networks (GSM or CDMA) when away. However, a number of combined Wi-Fi/mobile phones have appeared in OECD markets and could potentially become an even larger market for converged fixed/mobile services.*

The simplified network architecture and layering of NGNs delivers substantial operational and capital expenditure cost savings due to the economies of scope inherent in operating a converged IP network. Further, the IP Core networks and the associated equipment supporting application functionality — for example, application servers, softswitches, and IP/Interactive MultiMedia SubSystem (IMS) — create opportunities for network operators to provide a wider variety of services and applications, and to differentiate the products they offer to their customers.

From the perspective of a vertically-integrated operator with a fixed and mobile network, the cost savings from an IP core network are a key driver for investment to upgrade their network.

For mobile-only operators, while there are lower transmission costs from upgrading to an IP core network, a more important consideration for upgrading their core network is the ability to offer richer multimedia services to customers through the IMS — an architectural framework originally designed by the wireless standards body 3GPP to deliver IP multimedia services to end users.

Examples of the types of NGN services that can be offered by mobile carriers includes, presence and buddy lists content sharing, and multimedia communications, which will eventually be able to interoperate across all mobile networks in much the same way as SMS does today. The box titled "Six mobile innovations that will Change Our Lives" highlights the type of NGN services that mobile network operators currently supply or will be able to supply in the future.

In Australia, all mobile network carriers have upgraded to Next Generation IP core networks.

Six Mobile Innovations that will Change Our Lives

The following is a summary of an article by David Haskin, which was posted in April 2007 on TechWeb.com and subsequently reproduced on many other sites, including Forbes.com

In the article, several futurists and industry experts were asked to describe six key emerging mobile technologies and their impact on our lives. They were not talking about maybe-someday technologies, but applications that will be here in the next year or two. Some of them are even starting to be available now.

Key technology 1: Pay by Phone

Old way: Pull out your wallet and pay with cash, debit card, or credit card.

New way: Your cell phone acts as a mobile wallet; you wave the device at a point-of-sale reader to make purchases.

Key technology 2: Commanding Presence

Old way: You call, and if the person is not available, you leave a message.

New way: Supercharged "presence" capabilities tell you where a person is, what time zone they're in, where they are going, when they'll arrive, the best way to get in touch with them, and more.

Soon phones and other mobile devices will have supercharged presence capabilities that not only provide details about your availability but also help make you and those you connect with far more efficient and productive.

At a simple level, according to Chris Isaac, a partner in the PricewaterhouseCoopers Advisory practice specialising in the wireless industry, you will be able to program presence capabilities so that the phone rings when specific people call while others are automatically routed to voice mail. These presence "rules" will be tied to your location, which will be pinpointed by GPS capabilities in your mobile device, and will change automatically as you arrive, leave, or are en route to specific locations.

Key technology 3: Internet Everywhere, in Everything

Old way: You travel around looking for a Wi-Fi hotspot or other way to connect your laptop to the Internet.

New way: The Internet is everywhere and embedded in everything, from laptops and smartphones to intelligent alarm clocks and home infrastructure.

Ubiquitous connectivity is already becoming a reality. Even medium-sized U.S. cities, for instance, have 3G data service offered by cellular operators, which provides typical speeds of about 500 Kbit/s. In addition to 3G, mobile broadband technologies such as mobile WiMax will start being deployed widely in the next year. In other words, it won't be long before devices can be connected from virtually anywhere. The presence and location capabilities described above can also be integrated into these newly connected devices, according to the experts consulted.

For instance, say you are traveling and have an early flight. If that flight is delayed, the information could be sent directly to your Internet-enabled travel alarm clock, which could automatically reset itself so you can get a bit more shut-eye,

A service called Roborior has already emerged in Japan; a robot armed with wireless cameras enables users to monitor their home while they are away. If it senses a break-in, Roborior calls homeowners' cell phones to alert them.

In the future, systems are likely to emerge that can be set to automatically cool the house down (or warm it up, depending on the season) when you are a certain distance from home. Some vendors are starting to make home infrastructure applications available that work via text messaging, not only for heating and cooling systems but also for items such as burglar alarm systems. At least one vendor offers control of ovens via cell phones so that you can start the cooking process before you get home.

Key technology 4: Ubiquitous Media

Old way: You pack your music or even a video on your digital media player before you hit the road.

New way: Download and upload all types of media on all types of mobile devices wherever you are.

Doug Neal, a research fellow for global systems integration firm Computer Sciences Corporation's Leading Edge Forum Executive Programme, said the real story may well be making media transmissions a two-way street. That means you could, for instance, send live videocasts of your vacation to family and friends.

There is also an obvious business use for this sort of technology. "The use of two-way videophones will be important," Neal said. "If I'm doing business with you, I want to look you in the eye." This is another area in which NTT DoCoMo has taken a lead, and many hardware vendors have long been at work developing the chipsets and other technologies to make mobile videoconferencing common.

Key technology 5: Easier, Better Health Monitoring

Old way: The sick and elderly must find transportation to the nearest medical facility even for simple procedures.

New way: Real-time remote monitoring of medical conditions saves time and money, and allows faster, more helpful emergency responses.

The ubiquitous Internet is addressing the health monitoring problem with basic measuring and monitoring equipment that is wireless-network-enabled. Instead of scheduling an appointment and finding transportation, patients can wear monitors that transmit their vital signs directly to their medical providers. That information can be automatically inserted in the patient's health records and reviewed by medical personnel. When emergencies occur, emergency response personnel can be given accurate information while they are en route to the patient that will help them respond better.

Key technology 6: Remote tracking via GPS

Old way: Parents worry about where their children are and if they're safe. Trucking companies have the same worries about their drivers.

New way: Real-time monitoring pinpoints location and even checks truck drivers for sobriety.

Last year, Japan's NTT DoCoMo released a cell phone for children that enables parents to track their whereabouts. "There are GPS capabilities built into the phone so the parent can find out at all times where the child is," said Karen Lurker, U.S. communications manager for DoCoMo. "If the child feels they're in danger, they can hit a button and a very loud alert is sounded. And if somebody tries to take the battery out, an alarm goes out to the parent. This phone is extremely popular."

Another monitoring application using cellular data was created for a trucking company in Japan. This is a device that is similar to a breathalyzer that plugs into a phone with video capabilities, according to Lurker. "The (driver) takes the test over a live video connection with their headquarters," she said. "The video phone confirms the driver is the one doing the test, not somebody else."

Source: “Six Innovations That Will Change Your Life”, TechWeb, David Haskins, 9 August 2006

5.3 AUSTRALIAN MOBILE TELECOMMUNICATIONS INVESTMENTS

The mobile telecommunications industry is a capital-intensive one due to rapid technological advances and the requirements for building an extensive nationwide network infrastructure.

Initial 3G network investment

The first 3G network in Australia was launched by Hutchison in mid-April 2003 under the '3' brand. By the middle of that year, Hutchison Australia had invested more than $1 billion with the total investment anticipated then to be in the order of $3 billion. Of this, $1 billion was required to build the network, including the $196.1 million paid to secure 2100 MHz spectrum licences for 3G.

3G network sharing

To defray the massive costs associated with building new 3G mobile networks, both Hutchison and Telstra, and Vodafone and Optus announced they were entering into 3G network sharing arrangements in August 2004 using the 2100 MHz spectrum band. Both networks primarily covered major metropolitan and urban areas, with the Hutchison and Telstra network providing coverage to 56% of the population, and the Optus and Vodafone network providing coverage to 55% of the population.

The joint investments were examples of so-called "co-opetition'" where businesses cooperate to share the expensive infrastructure costs, whilst still competing commercially against one another for subscribers and operating separate customer service operations.

Recent 3G investments

In October 2006, Telstra launched a new national 3G network investment using the lower 850MHz spectrum band, which was built in ten months. The network currently covers 98.8% of the Australian population. In January 2007, Optus also announced that it would invest up to $800 million to extend its 3G mobile communications network from 55% to 96% of the Australian population.

All carriers have also recently enabled, or are in the process of enabling, their 3G networks with the High Speed Downlink Packet Access (HSDPA) standard. Today with an HSDPA-enabled device (a mobile phone or a data card), Australian consumers can experience speeds of between 600 kilobits per second (kbps) and 1.5 Megabits per second (Mbps) with a theoretical maximum speed of 3.6 Mbps.

As outlined in Section 2.1.3, longer term upgraded networks will in theory support downlink speeds of up to 14.4 Mbps, and provides carriers with an upgrade path to offer enhanced data services in the future. For consumers, HSDPA will mean shorter service response times, fewer waits and faster connections, and an increased offering of interactive services and applications — for example, real-time 'texting' and multi-player gaming.

Government investment

In August 2005, the Australian Government announced the $1.1 billion *Connect Australia* package, then the single largest investment in telecommunications services in the country, to improve broadband speeds and rollout, deliver better mobile phone coverage and help connect schools, hospitals and universities to the communications services they need.

On 18 June 2007, the Australian Government announced a funding and legislative initiative — *Australia Connected* — that aims to ensure that 99% of the population has access to fast affordable broadband by June 2009. $958 million of funding was granted to the Optus and Elders joint venture, OPEL Networks Pty Ltd (OPEL), which as part of the deployment to deliver broadband services to regional and remote areas, is installing 1361 broadband wireless sites using WiMax technology.[44]

[44] Information provided by Optus.

6. ECONOMIC IMPACT OF THE INDUSTRY

The mobile telecommunications industry makes a substantial contribution to the overall Australian economy. In addition to its direct contribution to aggregate output through value added by the industry, mobile telecommunications also benefit other industries and economic sectors by raising the labour productivity of workers. Access Economics has used its AE-GEM dynamic computable general equilibrium model to quantify the economy-wide impacts of falling mobile telecommunication prices and rising labour productivity resulting from increasing mobile penetration.

The modelling exercise draws upon some of the key insights revealed and explored in the preceding chapters of this report. These insights include:

- declining mobile telecommunication prices
  - benefiting consumers of mobile products and services, and
  - benefiting users of fixed-line services through competitive pressures from FTM substitution;
- increases in business productivity arising from the use of mobile phones (particularly among mobile workers); and
- increasing use of messaging services (SMS and MMS) and other forms of mobile data services due to the introduction, implementation and customer adoption of high-speed 3G network and new handset technologies.

6.1 DIRECT IMPACTS

The direct contribution an industry makes to the overall economy can be measured by industry value added or Industry Gross Product (IGP), which is calculated as follows:

IGP = turnover
+ change in the value of stocks
– purchases of inputs used to produce the good or service
– transfers in
– selected expenses

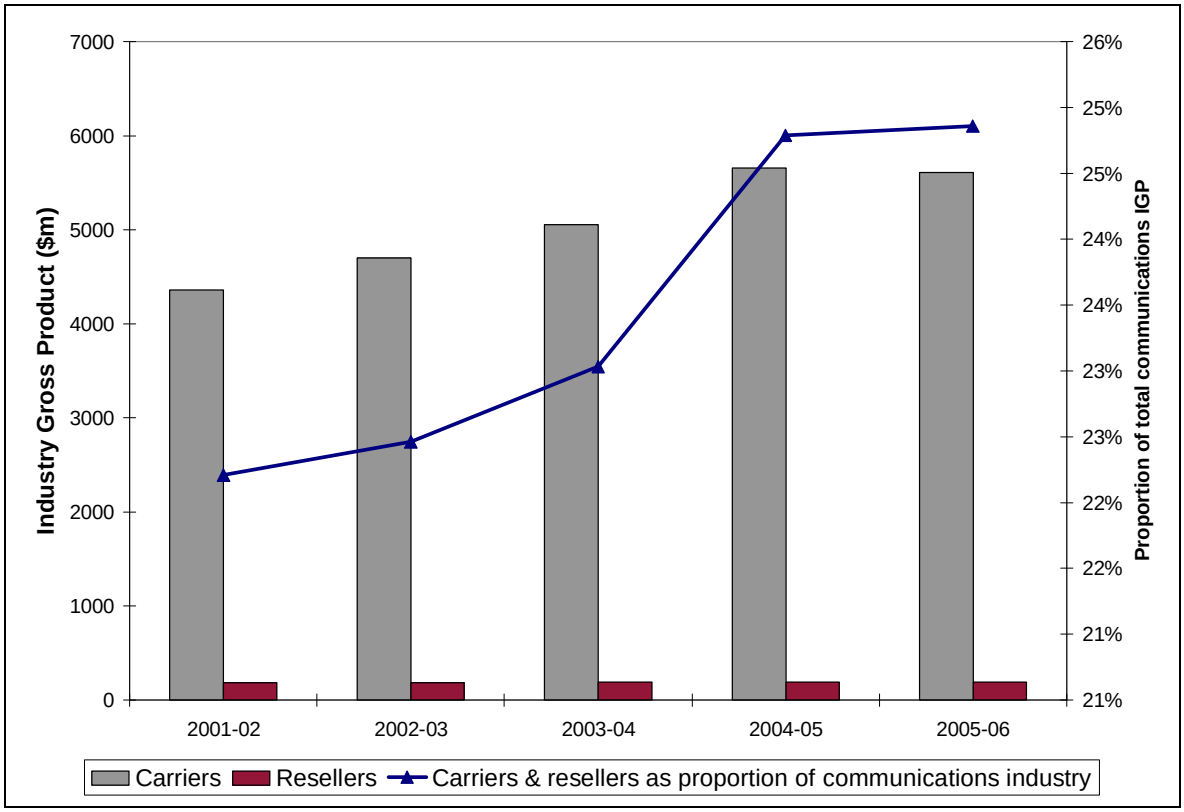
IGP describes the market value of goods and services produced by the industry, minus the cost of the inputs used to produce these goods and services. Gross domestic product (GDP) is computed by summing IGPs across all industries.

Between 2001-02 and 2005-06, the combined industry value added of mobile network carriers and resellers has increased from $4.5 billion to $5.8 billion while its share of value added in the whole communications industry rose from 22.2% to 24.9% (see Figure 6-1).[45] IBISWorld analysis suggests that the mobile telecommunications industry will account for 37% of total telecommunications sector value added in 2006-07. In 2005-06, the total value added across all industries (as measured by GDP) was $966 billion.

[45] The communications industry comprises postal and courier services in addition to telecommunications services, according to the Australian and New Zealand Standard Industrial Classification (ANZSIC).

In 2004-05, the combined IGP of mobile network carriers and resellers was higher than that for either free-to-air television services, the newspaper, printing and publishing industry or the computer consultancy services sector. It was almost three times as large as that of the automotive, vehicle and component manufacturing sector.

FIGURE 6-1: INDUSTRY GROSS PRODUCT, 2001-02 TO 2005-06



Source: IBISWorld, ABS 5204.0

6.2 INDIRECT IMPACTS

The growth in mobile telephony and advances in wireless technology are likely to generate economic benefits within the telecommunications industry.

The economic impact of the mobile telecommunications industry, however, extends beyond the revenues and value-added it generates, the workers it employs, and the wages paid out to these workers. Falling mobile prices have increased consumer benefits from telecommunications. Furthermore, the ubiquity of mobiles has transformed the way businesses operate and their employees work in almost every industry and sector of the Australian economy. This means that the economic impact of the mobile telecommunications industry encompasses its flow-on impacts on all other industries.

While there have been many assertions about the economic contribution the mobile telephone industry makes, there has been little quantification of its economy-wide benefits. Previous work showing the economic significance appear to have relied upon simplistic

[47] For example, a report commissioned by the mobile telephone provider O_2 and produced by the Centre for Economic and Business Research (CEBR) in 2004, used contribution analysis to highlight that the mobile industry contributed 2.2% of UK GDP (£22.9 billion in 2003).

contribution studies lacking in analytical rigour to estimate the contribution the mobile industry had made to Gross Domestic Product (GDP).[47] While ACMA has commissioned general equilibrium (GE) analysis of the telecommunications industry in Australia, it has been confined to examining the overall impact of competitive reforms in the entire telecommunications industry on the economy.[48] In one of the few attempts to measure the consumer benefits derived from mobile telecommunications industry, Hausman econometrically estimated, using year-end 1999 data, that the introduction of the mobile telephone in 1989 increased consumer surplus in the US by between US$52.8 - US$111 billion.[49]

To fill this knowledge gap, Access Economics has applied its in-house GE model, AE-GEM, to analyse the broader macroeconomic impacts of recent developments in mobile telecommunications. A description of the model is given in Appendix B.

6.2.1 MODELLING THE BENEFITS OF MOBILE TELECOMMUNICATIONS

In this modelling exercise, Access Economics divided the telecommunications sector into four sub-sectors: fixed-line voice, fixed-line data, mobile voice and mobile data. The analysis considered two components when modelling the impacts of mobile telecommunications on the Australian economy — price declines and productivity increases.

Price Declines

The first component is the impact of lower prices paid by both consumers and business for mobile telecommunications specifically, and telecommunications more generally.

The observed changes in telecommunications prices in Australia are shown in Table 6-1. The data show that the overall price of telecommunications has been generally falling over the period 2001 to 2006. This reduction in price is largely driven by a reduction in mobile telecommunications prices. For example, the ACCC's mobile price index fell by just under 13 per cent in 2005, compared with the PSTN (traditional fixed-line voice services) price decline of 1.2%. This combined to give a telecommunications price decrease of 6.6% in that year.[50]

According to the ACCC, in 2006, the mobile telecommunication price index fell by 6.5% while PSTN or fixed-line prices fell by 6.6%. They suggest this reduction was in part due to the move by fixed-line operators to offer capped plans, following the popularity of such pricing plans for mobile services.[51]

The mobile telecommunications price reductions in Table 6-1 and Figure 6-2 were assessed against a counterfactual of prices rising in line with the consumer price index (CPI). That is, a scenario where the price of telecommunications price from 2001 follows the data in Table 6-1 is compared against a scenario where telecommunications prices increase in line with the CPI. The price reductions were brought about by productivity improvements in the mobile voice and fixed voice sectors, combined with pressure on profit margins.

[48] The study's results are available in Chapter 11 of the ACMA, *ACMA Communications Report 2005–2006*.

[49] J. Hausman, "Mobile Telephone", *Handbook of Telecommunications,* Volume 1, M.E. Cave, S.K. Majumdar and I. Vogelsang (eds.), Elsevier Science B.V, 2002, p 586.

[50] ACCC, *ACCC Telecommunications Report 2004-05 — Report 2*, April 2006.

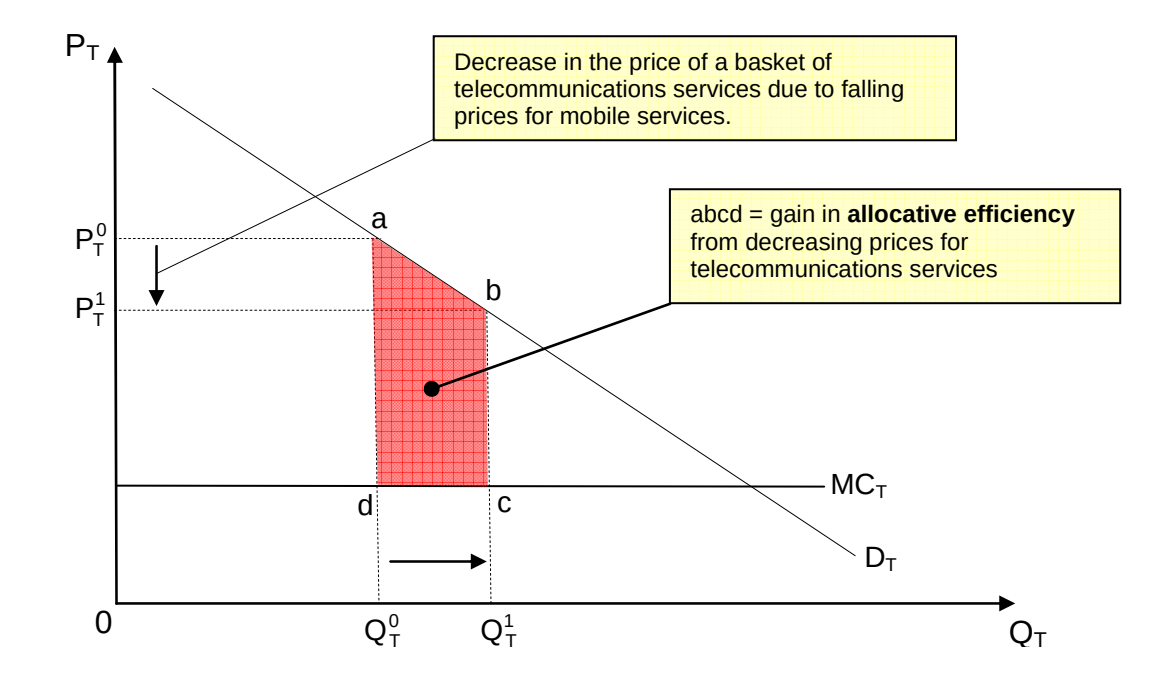
[51] ACCC, *ACCC Telecommunications Report 2005-06 — Reports 1 and 2*, May 2007.

Economic Benefits of Falling Mobile Prices on the Telecommunications Sector

The fall in price of mobile telecommunications services in Australian creates economic benefits for consumers of telecommunications services, as there will be:

- gains to consumers of mobile services; and
- gains to consumers of telecommunications services more generally through the price pressure that mobile services places on fixed-line services in Australia — that is, the competitive pressure on fixed services due to fixed-to-mobile substitution.

Therefore, the price decrease in mobiles services places downward pressure on the price of a basket of telecommunications services, and the price-quantity diagram below captures the economic benefits associated with such an effect.



The diagram adopts the following notation:

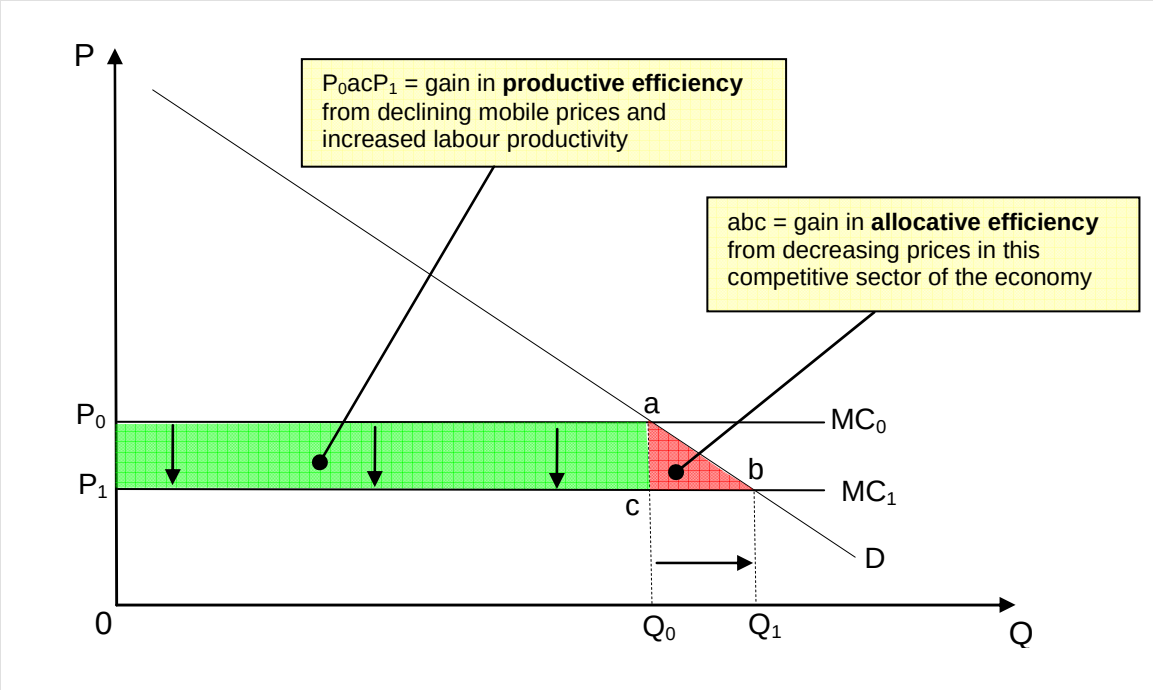
- D_T denotes the demand curve for telecommunications services;
- MC_T denotes the (constant) marginal cost to society associated with supplying telecommunications services;
- P_T is the per-unit price of telecommunications services; and
- Q_T is the quantity of telecommunications services.

It illustrates that with a fall in the price of a basket of telecommunications services from P_T^0 to P_T^1, there will be an increase in the demand for telecommunications services from Q_T^0 to Q_T^1. As consumers value these additional units supplied from Q_T^0 to Q_T^1 by the amount $abQ_T^1Q_T^0$, and the cost to society of supplying these units is only $dcQ_T^1Q_T^0$, the increase in supply creates an overall increase in allocative efficiency equal to the red-shaded area abcd.

Economic Benefits on the Overall Economy

Aside from mobile services being consumed, mobiles are also an input for many businesses across many different sectors of the economy. Studies, such as that by the CEBR on behalf of O_2, suggest that mobiles have a positive impact on the productivity of workers, and this will lead to gains in productive efficiency across the economy. These gains augment those from lower costs of telecommunications to businesses due to falling mobile and fixed-line prices.

The figure below captures this effect, by illustrating the increase in efficiency associated with a productivity gain in a particular competitive sector of the economy.



Using similar notation to the previous box, but discarding the subscript T which was used to denote the telecommunications industry, the impact of mobiles on labour productivity in competitive sectors in the economy, is to decrease the marginal cost of production to society from MC_0 to MC_1, decrease the price from P_0 to P_1, and increase quantity from Q_0 to Q_1. The decrease in the cost of supplying Q_0 units, leads to a gain in productive efficiency equal to the green-shaded rectangle area P_0acP_1, while the increase in quantity from Q_0 to Q_1 leads to a gain in allocative efficiency equal to red-shaded triangle area abc. Therefore, across each competitive market, the increase in productivity resulting from mobile telecommunications services generates an overall efficiency gain equal to area P_0abP_1.

It is assumed that there was no further mobile price reductions from the levels shown in 2006 and that there were some flow-on effects from mobile competition to PSTN services. It is further assumed that mobile competition is responsible for one seventh of the reduction in prices of PSTN services shown in Table 6-1.

The economic benefits of declining mobile prices on the telecommunications sector and the economy are explained in the boxes on the preceding pages.

Productivity Increases

The second component of the scenario considered the impact of mobiles on labour productivity throughout the economy. As discussed previously in Section 5.1, a study by CEBR on behalf of the mobile phone provider O_2 estimated that, on average, each worker in the UK in 2004 saved 20 minutes per week from the use of mobile phones. The increase in productivity results from mobiles allowing workers:

- closer contact with work colleagues;
- to plan their schedules on the move;
- to make important calls to customers or suppliers during travel time;
- to catch up with developments at their base; and
- more opportunities for 'a quick chat' to reassure clients and to build and reinforce client networks.

TABLE 6-1: OBSERVED CHANGES IN REAL TELECOMMUNICATIONS PRICES, 2001 TO 2006

Price index	2001	2002	2003	2004	2005	2006
Telecommunications						
Price index	100.00	97.66	98.52	97.41	91.00	85.08
Change in index	-6.54	-2.34	0.86	-1.11	-6.41	-5.92
% change in Index	-6.13	-2.34	0.88	-1.13	-6.58	-6.50
PSTN						
Price index	100.00	97.36	98.44	98.68	97.48	91.11
Change in index	-6.25	-2.64	1.08	0.24	-1.20	-6.37
% change in Index	-5.88	-2.64	1.11	0.24	-1.22	-6.6
Mobile						
Price index	100.00	97.92	98.83	95.70	83.33	77.86
Change in index	-7.29	-2.08	0.91	-3.13	-12.37	-5.47
% change in Index	-6.80	-2.08	0.93	-3.16	-12.93	-6.5

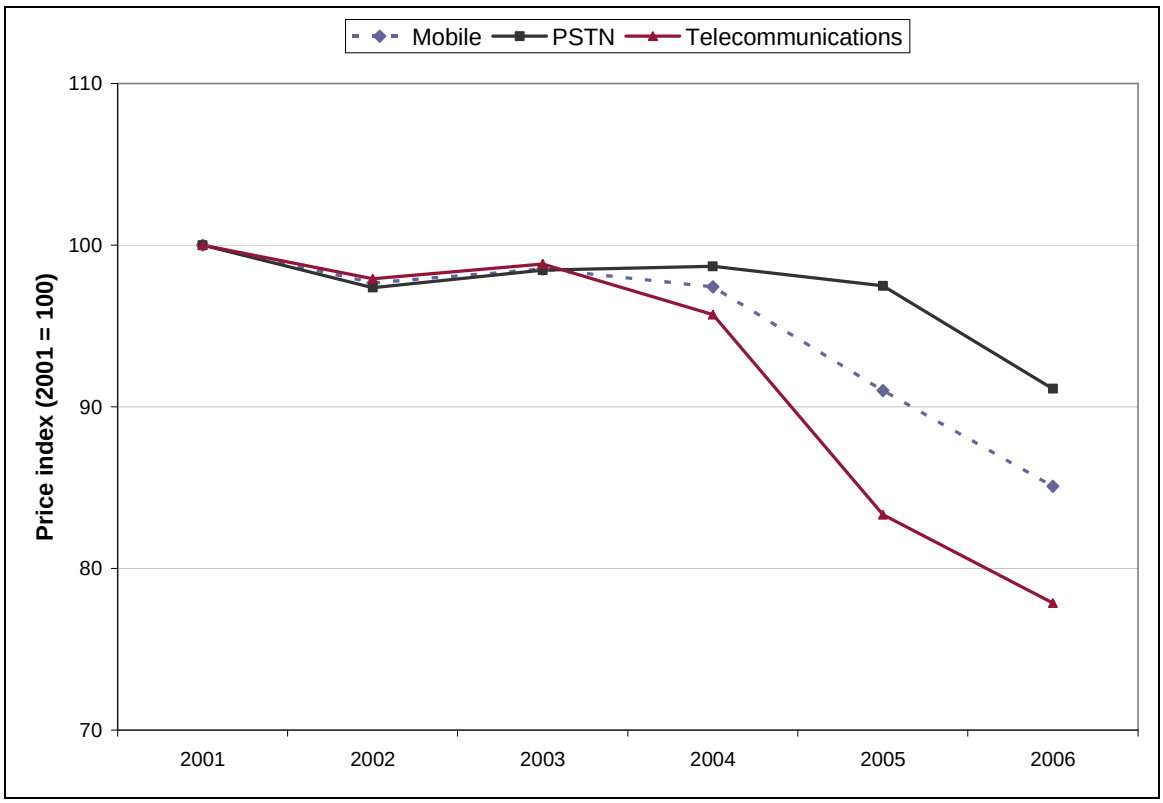
Source: *ACCC Telecommunications Reports — Report 2*, various years

Note: Data has been re-indexed with 2001 as the base year.

The 20 minutes per week saved by a worker in the UK using a mobile phone translated into a 0.88% annual labour productivity improvement in 2004 when mobile penetration rate in the UK was approximately 90%.

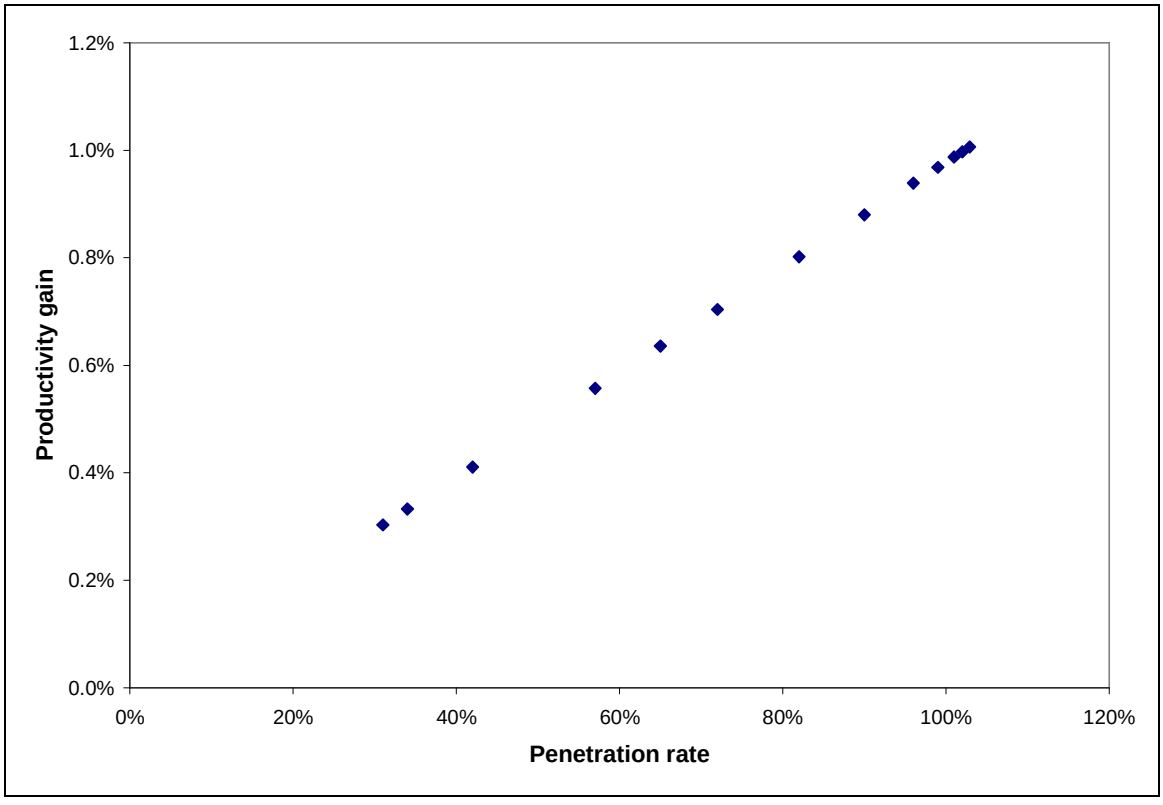
The overall improvement in Australian labour productivity in Access Economics' modelling is calculated by taking into consideration the mobile penetration rate that is growing over time. The relationship between the gain in labour productivity and the penetration rate is shown in Figure 6-3. It is assumed that the labour productivity improvement is uniform across different sectors of the economy. The productive efficiency gains in a given sector of the economy from mobiles improving overall labour productivity are explained in the box entitled 'Economic Benefits on the Overall Economy'.

FIGURE 6-2: PRICE INDICES USED IN MODELLING EXERCISE



Source: Access Economics

FIGURE 6-3: RELATIONSHIP BETWEEN LABOUR PRODUCTIVITY GAIN AND PENETRATION RATE



Source: Access Economics

6.2.2 RESULTS FOR 2006

The estimated economic impact of mobile telecommunications on the Australian economy was to raise economic growth as measured by GDP, in real terms, by $6.4 billion in 2006 (see Table 6-2). That is to say, if mobile price levels had not fallen relative to the CPI from 2001, and there were no flow-on effects to PSTN prices or labour productivity, Australia's GDP growth would have been $6.4 billion lower in 2006. By comparison, in a 2005 report for ACMA, ACIL Tasman estimated the impact of post-1996 reforms to the entire telecommunications industry on GDP to be $15.2 billion in 2005-06.

Australia's economic welfare, measured by GNP, was projected to increase by just over $6 billion in 2006.[53] In addition, investment and employment were projected to be stronger as a result of mobile telecommunications. For example, mobile telecommunications were projected to increase employment by 53,000 FTEs in 2006. In addition, the productivity enhancing effects of mobile telecommunications exerted downward pressure on prices (reflected in the projected decline in the CPI), while increasing real wages.

TABLE 6-2: ECONOMIC IMPACTS IN 2006

Variable	Change from baseline values ($m)	Variable	% deviation from reference case
Real GDP	6,414	Real GDP	1.27
Real GNP	6,024	Real GNP	1.19
Real Consumption	3,692	Real Consumption	1.20
Real Investment	3,018	Real Investment	2.91
Real Exports	-42	Real Exports	-0.04
Real Imports	1,345	Real Imports	1.36
Employment ('000)	53	CPI	-0.11
		Real Wage	0.99
		Employment	0.42

Source: Access Economics

6.2.3 BENEFITS OF MOBILE DATA IN 2007 AND BEYOND

Access Economics has also produced a forward estimate of the economy-wide benefits flowing from a projected increase in mobile data use made possible by 3G networks. While there is no new empirical evidence behind the specific parameters that have been chosen in this scenario, the simulation has been designed to illustrate the possible scale of the economy-wide benefits of further improvements in labour productivity from new services offered by mobile telecommunications.

In this simulation, it is assumed that the ability to access and exchange complex data and other information while on the move saves skilled workers who possess the enabling mobile technology (such as a subscription to a 3G network and a smartphone) an additional 20 minutes per week. The adoption rate of such enabling technology among skilled workers is assumed, conservatively, to accelerate from 0% in 2005 to 20% in 2010.

[53] GDP measures the output produced in Australia and includes income generated by foreigners residing in Australia. GNP measures the output and income generated by Australians, including those living abroad.

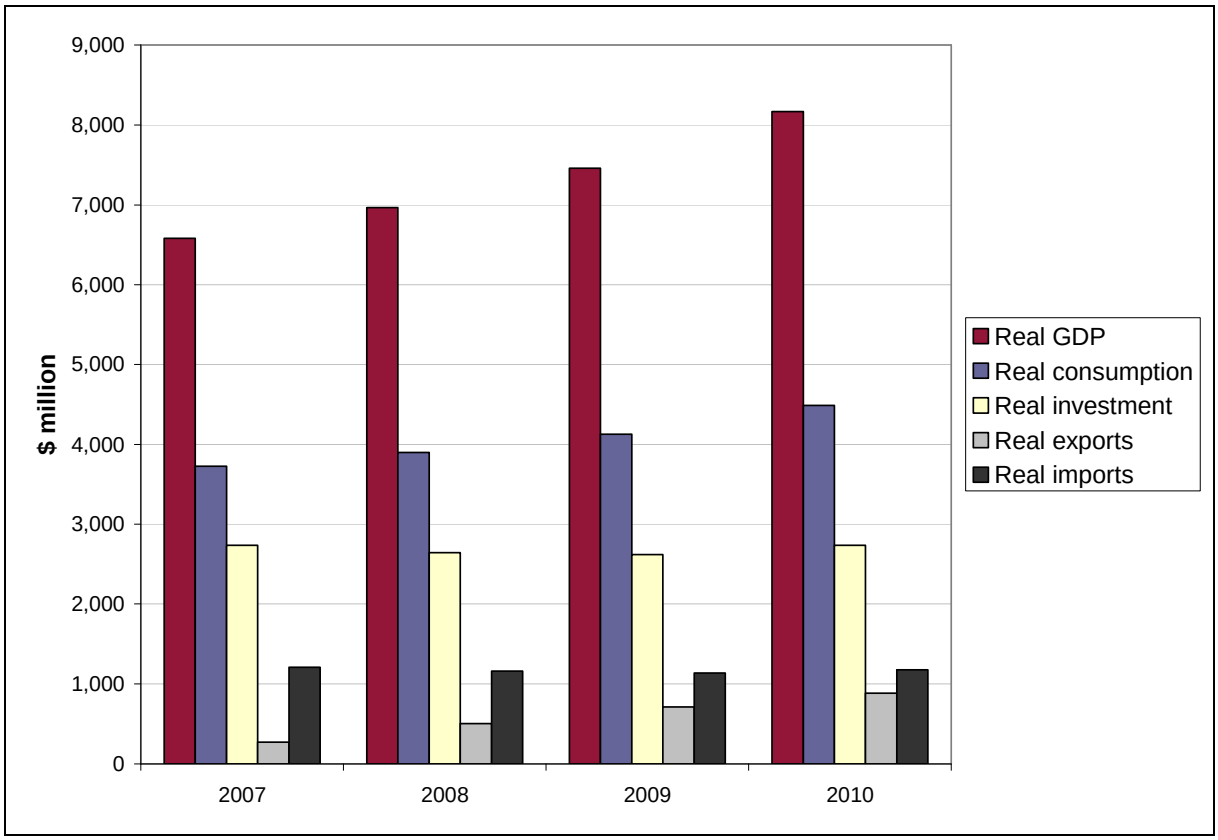
As can be seen in Table 6-3 and Figure 6-4, the total benefits from mobile voice and data, as measured by GDP, is estimated to rise from approximately $6.6 billion in 2007 to $8.2 billion in 2010. (The estimated benefit in terms of GDP from mobile voice alone is approximately $7.2 billion in 2010.) The additional gains in real consumption and real investment from the increasing use of mobile data (above and beyond the benefits from mobile voice) are estimated to be about $0.54 billion and $0.42 billion by 2010 respectively. Real imports are expected to increase due to rising income levels.

TABLE 6-3: ECONOMIC IMPACTS OF MOBILE VOICE AND DATA (CHANGE FROM BASELINE VALUES), 2007 TO 2010

Variable	2007	2008	2009	2010
Real GDP ($b)	6.58	6.97	7.46	8.17
Real GNP ($b)	5.98	6.18	6.51	7.08
Real Consumption ($b)	3.73	3.90	4.13	4.49
Real Investment ($b)	2.74	2.65	2.62	2.74
Real Exports ($b)	0.27	0.50	0.71	0.89
Real Imports ($b)	1.21	1.16	1.14	1.18

Source: Access Economics

FIGURE 6-4: BENEFITS FROM MOBILE VOICE AND DATA, 2007 TO 2010



Source: Access Economics

6.2.4 SUMMARY OF MODELLING RESULTS

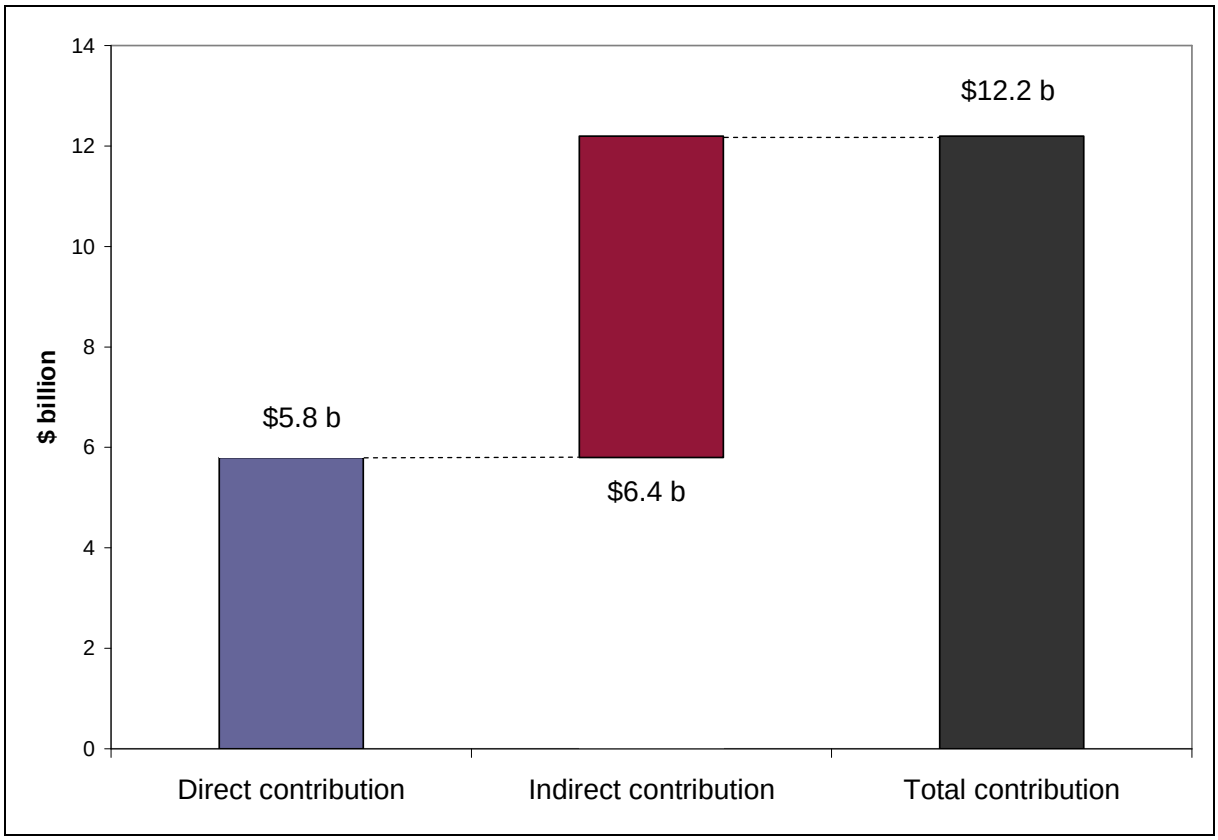
The modelling results suggest that, in 2006, the mobile telecommunications sector:

- increased Australian real gross domestic product (GDP) by $6.4 billion with associated positive impacts on investment (up by $3.7 billion) and household consumption (up by $3.0 billion);
- increased Australian welfare, measured by real gross national product (GNP), by $6.0 billion ;
- increased employment by 53,000 Full-Time Equivalents (FTEs); and
- lowered pressure on Australia's Consumer Price Index (CPI) while at the same time raising real wage rates.

In addition, the increasing uptake of 3G technology and the consequent increase in mobile data traffic are expected to add an additional $1 billion to GDP by 2010 (above and beyond the gains from mobile voice).

It is interesting to note that the broader impacts on GDP are even larger than the direct value added by the industry (as measured by the combined industry gross product or IGP of mobile telecommunications carriers and resellers, which was $5.8 billion in 2005-06 — see Figure 6-5 below). Results from similar studies conducted overseas are discussed in the box on the following page.

FIGURE 6-5: DIRECT AND INDIRECT ECONOMIC CONTRIBUTIONS OF MOBILE TELECOMMUNICATIONS, 2006



Source: Access Economics

International Evidence on the Mobile Industry's Economic Contributions

The results from several key studies on the economic impact of mobile telecommunications in Asia and Europe are discussed below.

Asia

McKinsey reports the total economic impact of mobile phones in China, India and the Philippines. The total economic impact of wireless is defined as the sum of three elements: the direct impact from mobile operators, the indirect impact from other companies in the wireless business system (hardware and software vendors, handset vendors, and so on), and a second form of indirect impact: the surplus enjoyed by end-users. This surplus includes improved productivity for mobile workers and the less tangible, but nonetheless valuable benefits of access to family, improved security, peace of mind, and other virtues enjoyed by both enterprise workers and consumers.

The total impact of wireless in the three countries studied greatly exceeded expectations. In China, the total economic impact in 2005 was $108 billion, or the equivalent of about 5% of GDP (the corresponding figures for India and the Philippines were 1.3-1.9% and 7.5% respectively). Of the total impact, only $24 billion was direct. Indirect impact amounted to $84 billion: a $47 billion contribution to GDP from other wireless business, such as equipment and handset makers, and at least $37 billion from end-use surplus.

To calculate productivity improvement in China, McKinsey conducted extensive market research, including 608 interviews with consumers in 14 cities of varying sizes. They found that, on average, the productivity improvement (that is, work time saved) was roughly 6% for high mobility workers, who constitute 25% of the Chinese labour force. End-user consumer surplus was assumed to be equal to average revenue per unit (ARPU) at the time of subscription to wireless services minus ARPU at the time of the study and assumes the user's willingness to pay does not change over time.

Europe

Ovum, in a modelling exercise for Vodafone, found that the UK mobile industry generated £11.4 billion additional GDP in 2002/03. It was found that most of the value added was at the downstream end of the value chain in service offerings (which was dominated by local employment) than at the upstream, manufacturing end of the chain (which was increasingly dominated by suppliers of components and platforms located in the Asia-Pacific region).

The UK mobile industry also directly generated 77,000 jobs within the industry, while firms providing support services to the industry employed a further 113,000 staff. In addition, the industry generated a further 84,000 jobs indirectly, based on the assumption that Governments spend the taxes raised from the industry, and that owners and funders spend their returns from the industry in a way that generates further employment.

Finally, taking into account of the multiplier effect which induces further employment, the 274,000 EU jobs which depend either directly or indirectly on the UK mobile services industry generate expenditure in the economy which, in turn, creates other jobs. Using the UK Office of National Statistics' estimate of a multiplier of 1.5 for telecommunications, the total number of jobs dependent on the UK mobile industry rises further to 411,000.

International Evidence (continued)

In a broader study (again for Vodafone) utilising a similar methodology as the UK study, Ovum found that mobile services of the EU15 region generated €105.6 billion in GDP in 2004, 2,800,000 jobs, and €83.9 billion per annum in revenues for member state governments. (Ovum has also quantified the economic contribution of the mobile industry in Africa, South America, Bangladesh, India and other countries.)

However, these results are likely to overstate the economic contribution of the UK and EU mobile industries due to the multiplier-based methodology used in the study. Sophisticated general equilibrium (GE) modelling, as employed by Access Economics, produces more realistic results as GE models take into explicit consideration resource constraints in the overall economy. For example, an expanding mobile industry would tend to draw resources away from other industries if the economy is already operating close to full capacity. The potential shrinkage of these industries is not considered in the simple multiplier approach.

Sources: McKinsey *Wireless Unbound: The Surprising Economic Value and Untapped Potential of the Mobile Phone*, September 2006; Ovum (by D. Lewin and D. Kalianiotis), *The Employment Effects of UK Mobile Services: A Report to Vodafone*, Ovum, 2006.

7. POLICY IMPLICATIONS AND CONCLUSION

The preceding chapters have shown that the mobile telecommunications industry contributes substantially to the Australian economy. In addition to its direct contributions, it drives productivity gains throughout the economy. This characteristic of the mobile telecommunications industry contrasts with other key sectors such as mining, which makes a significant direct contribution to the economy but much smaller indirect contributions.

Robust aggregate demand, due in part to the voracious appetite of fast-growing developing economies like China and India for Australian commodities, has resulted in very high employment and capacity utilisation levels in Australia. This means that future economic growth and prosperity must come largely from key drivers of aggregate supply such as population, workforce participation and productivity (the three 'Ps' in the Treasury's parlance).

Productivity growth surged in Australia in the 1990s as a result of extensive microeconomic reforms adopted by the Australian Government that enhanced competition and increased openness to trade, as well as the rapid adoption of new information and communication technologies (ICT) by businesses. These two developments were symbiotic and mutually reinforcing.

By being open to imports of ICTs, Australia has been able to gain quickly from advances in ICT manufacture and has been able to capture a sizeable terms of trade gain from the rapidly declining international prices in ICTs. Sharper competitive incentives to be productive also help explain why Australia moved from being a technology laggard in previous decades to being at the forefront of technology uptake in the 1990s.[54]

Research conducted and commissioned by the Department of Communication, Information Technology and the Arts (DCITA) show that ICT influenced labour productivity growth through its effect on multifactor productivity (MFP) growth through technological changes, capital investment in ICT and the effect of falling ICT prices on the constant price valuation of ICT capital. In service industries, between 35% and 65% of MFP growth is estimated to have been driven by technological factors — mainly ICT related.[55] In manufacturing, the range was between 45% and 75% (see Table 7-1).[56]

After the stellar performance of the 1990s, productivity growth appears to have stalled in Australia since the beginning of the new millennium. As can be seen in the chart and table on the following pages reproduced from a recent Productivity Commission paper, Australia continues to lag behind the US in overall productivity and in the productivity of many individual industries.[57]

[54] D. Parham, "Productivity Gains from Policy Reforms, ICTs and Structural Transformation", Productivity Commission, a paper submitted to the IAOS Conference on the New Economy, London, 27-29 August 2002.

[55] DCITA, *Productivity Growth in Service Industries*, 2005.

[56] National Office for the Information Economy (NOIE), *Productivity Growth in Australian Manufacturing*, 2004.

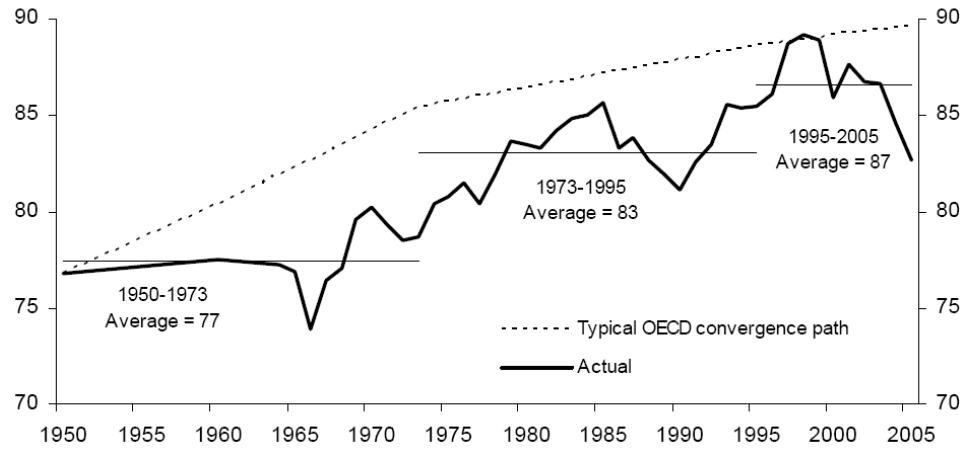
[57] B. Dolman, D. Parham and S. Zheng, "Can Australia Match US Productivity Performance?", Productivity Commission Working Paper, March 2007.

TABLE 7-1: DRIVERS OF LABOUR PRODUCTIVITY GROWTH, 1984-85 TO 2001-02

	Lower estimate		Upper estimate	
Labour productivity (LP) growth attributed to	Annual contribution	Share	Annual contribution	Share
	%	%	%	%
Service industries				
Increased capital spending per worker	1.02	46	1.02	46
Falling ICT prices	0.45	20	0.45	20
MFP growth due to technical change	0.27	12	0.50	22
MFP growth due to institutional change	0.50	22	0.27	12
Annual LP growth	2.24	100	2.24	100
Manufacturing				
Increased capital spending per worker	0.75	34	0.75	35
Falling ICT prices	0.28	13	0.28	13
MFP growth due to technical changes	0.51	24	0.85	39
MFP growth due to institutional change	0.62	29	0.28	13
Annual LP growth	2.16	100	2.16	100

Source: DCITA, *Productivity Growth in Service Industries*, 2005

Figure 4.1 **Australia chasing the frontier**
Australian productivity, per cent of US level[a]



[a] The 'typical convergence path' is based on average OECD speeds of convergence for the periods 1950 to 1973, 1973 to 1995 and 1995 to 2005, as detailed in box 3.1.

Data source: Authors' calculations based on The Conference Board and GGDC, (*Total Economy Database*, September 2006).

Table 4.1 **Catch-up in Australian productivity levels, 1979 to 2003**

	Growth rate in the United States	*Australia's growth rate relative to the United States*	*Australian labour productivity*		
			1979	1998	2003
	per cent per year	percentage points per year	per cent of US level		
Agriculture, forestry and fishing	3.7	-0.8	94	69	78
Mining	2.7	0.3	186	203	199
Manufacturing	3.7	-1.3	83	71	60
Electricity, gas & water	3.5	1.1	41	71	53
Construction	-0.8	2.2	74	111	124
Trade	2.6	-0.1	62	60	60
Wholesale trade	4.3	-1.0	55	33	43
Retail trade	2.5	0.2	60	73	63
Accommodation, cafés & restaurants	0.3	0.1	85	84	87
Transport & communications	2.5	-0.6	98	95	85
Transport & storage[a]	2.3	-2.5	179	95	98
Communications	2.9	3.0	41	114	83
Financial & business services	0.4	-0.5	97	90	85
Finance & insurance	2.6	0.3	62	73	67
Property & business services	-0.5	-1.1	120	96	93
Public services	-0.2	0.9	100	124	124
Other services	1.4	-0.6	83	71	72
Whole economy	**1.6**	**0.1**	**84**	**89**	**87**

Source Productivity Commission, "Can Australia Match US Productivity Performance?", 2007

A recent paper from the Australian National University's Centre for Law and Economics (commissioned by DCITA) show that more intensive use of ICT capital in the US and its diffusion explained around 44% of the Australian–US productivity gap in 2000, and about 28% in 2003.[58]

Innovation in mobile telecommunications in the past few years have focused on the convergence of communication, media and information technologies in order to facilitate wider and more integrated methods for information distribution. This convergence means that governments should have a consistent and integrated set of policies and regulations that will not inhibit, but rather facilitate, rapid uptake of emerging ICTs by households and businesses. Where possible, such policies could be developed through a cooperative approach and engagement with industry. Only then can mobile telecommunications continue to foster productivity gains across Australian industries and assist in closing the productivity gap between Australia and leading edge countries like the US.

[58] G. Barker, L. Waverman, L. Fuss and R. Tooth, *ICT networks and Productivity: Australia in Perspective*, a paper prepared for DCITA, 2006

APPENDIX A

ORGANISATIONS INVOLVED WITH THE MOBILE TELECOMMUNICATIONS INDUSTRY IN AUSTRALIA

The table below lists the government departments, industry organisations and consumer/user groups involved with the Australian mobile telecommunications industry.

Organisation	Activities and role
Government departments	
Australian Communications and Media Authority (ACMA)	ACMA is responsible for regulating broadcasting, radiocommunications, telecommunications and online content. Its responsibilities include spectrum management and promoting industry self-regulation and competition, while protecting consumers and other users.
Department of Communications, Information Technology and the Arts (DCITA)	DCITA provides policy advice and program support to the Australian Government on arts, information technology, communications and sport portfolio issues. The Minister for Communications, Information Technology and the Arts is responsible for the development of Australia's communications, information technology and cultural outcomes.
Australian Competition and Consumer Commission (ACCC)	The ACCC's Telecommunications Group has prime responsibility for administering the Commission's functions for competition and economic regulation of telecommunications, and forms part of both the ACCC's Regulatory Affairs Division (in terms of regulatory pricing and access work) and its Compliance Division (in terms of its competition enforcement work).
Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)	A part of the Health and Aging Portfolio, ARPANSA is an Australian Government agency charged with protecting the health and safety of people and the environment from the harmful effects of ionising and non-ionising radiation (including radio frequency emissions).
Industry organisations	
Australian Mobile Telecommunications Association (AMTA)	AMTA is the peak industry body representing Australia's mobile telecommunications industry. AMTA's vision is to promote an environmentally, socially and economically responsible, successful and sustainable mobile telecommunications industry in Australia. AMTA represents, acts, and communicates on behalf of industry to key stakeholders and decision makers: governments; regulatory authorities; consumer groups; and mobile users. AMTA's members include the mobile phone carriers, handset manufacturers, retail outlets, network equipment suppliers and associated businesses, as well as specialised consultancy services.

Organisation	Activities and role
Telecommunication Industry Ombudsman (TIO)	Established in 1993 by the Australian Government, the TIO is funded by industry but is independent of industry, government and consumer organisations. The TIO is authorised to investigate complaints about the provision or supply o telephone or Internet services. The role and powers of the TIO are included in the *Telecommunications (Consumer Protection and Service Standards) Act 1999*.
Communications Alliance	Communications Alliance was formed in 2006 from the merger of the Australian Communications Industry Forum (ACIF) and the Service Providers Association Inc (SPAN) to provide a unified voice for the Australian communications industry and to lead it into the next generation of converging networks, technologies and services. The Alliance's prime mission is to promote the growth of the Australian communications industry and the protection of consumer interests by fostering the highest standards of business ethics and behaviour through industry self-governance.
Telephone Information Services Standards Council (TISSC)	TISSC is an independent regulatory body that sets standards for the message content and advertising of any Australian telecommunications service with the prefix 190, in the form of a Code of Practice. Service providers of 190 numbers must abide by the TISSC's Code of Practice.
Consumer/user groups	
Australian Telecommunications Users Group Ltd (ATUG)	Formed in 1981, ATUG is a not-for-profit membership-based organisation of Australian telecommunications users. It focuses on delivering practical services for its members, leveraging their experience to identify new policies that can improve the telecommunications regime. ATUG also helps members share their experiences so that all ATUG obtain better value for their telecommunications dollar.
Small Enterprise Telecommunications Centre Ltd (SETEL)	SETEL is a national consumer association advancing the telecommunications and e-commerce interests of Australian small business. The Commonwealth of Australia supports representation of small business consumers in relation to telecommunications and e-commerce issues in national forums by SETEK through DCITA's 'Grants to Fund Telecommunications Consumer Representation program.
Consumers Telecommunications Network (CTN)	CTN is a national coalition of consumer and community organisations that represents community interests in the national policy arena on telecommunications issues. CTN is an important voice promoting better access, quality of service and affordability of telecommunications services for residential consumers. CTN members include national and State organisations representing consumers from non-English speaking backgrounds, deaf consumers Indigenous people, low-income consumers, people with disabilities, pensioners and superannuants, rural and remote consumers, women and consumers in general.

APPENDIX B

THE AE-GEM MODEL IN GREATER DETAIL

AE-GEM is a large scale, dynamic, multi-region, multi-commodity computable general equilibrium model of the world economy. The model solves for the supply and demand of commodities and factors of production determined by the behaviour of the agents represented in the model: producers, investors, households and governments. These agents optimise their behaviour in each region of the model. For example, consumers maximise utility subject to a budget constraint, producers maximise profits subject to constant returns to scale technology operating in perfectly competitive markets.

AE-GEM is based on a substantial body of accepted microeconomic theory. This model projects changes in macroeconomic aggregates such as GDP, employment, export volumes, investment and private consumption. At the sectoral level, we are able to provide detailed results such as output, exports, imports and employment. Key assumptions underpinning the model are:

- The model contains a 'regional consumer' that receives all income from factor payments (labour, capital, land and natural resources), taxes and net foreign income from borrowing (lending).
- Income is allocated across private household consumption, government consumption and savings in an equivalent fashion to the maximisation of a Cobb-Douglas utility function.
- Private household consumption is determined to maximise utility (through a Constant Difference in Elasticity (CDE) of substitution function) and minimise cost by substituting domestic and imported commodities (through a Constant Elasticity of Substitution (CES) aggregator).
- Government consumption is determined to maximise utility (through a Cobb-Douglas function) and minimise cost by substituting domestic and imported commodities (through a Constant Elasticity of Substitution (CES) aggregator).
- All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of generating capital.
- Producers supply output through combining intermediate inputs and primary factors in fixed proportions (the Leontief assumption).
- Intermediate inputs are assumed to be combined in fixed proportions at the composite level.
    - The model contains a more detailed treatment of the communications sector which is defined as four separate technologies: fixed voice, mobile voice, fixed data and mobile data. The 'technology bundle' approach for general equilibrium modelling was developed by ABARE.[59]
- To minimise costs, producers substitute between domestic and imported intermediate inputs is governed by the Armington assumption as well as between primary factors of

[59] Australian Bureau of Agricultural and Resource Economics (ABARE), *MEGABARE: Interim Documentation*, Canberra, 1996.

production (through a CES aggregator). Substitution between skilled and unskilled labour is also allowed (again via a CES function).

- The supply of labour is positively influenced by movements in the wage rate governed by an elasticity of supply is (assumed to be 0.2).
- Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. The global investor that ranks countries as investment destination based on two factors: current economic growth and rates of return in a given region compared with global rates of return.
- Once aggregate consumption is determined, the investor is assumed to consume composite investment commodities in fixed proportions, and minimize costs by substituting domestic for imported commodities (CES).
- Sectoral output equals the amount demanded by consumers (households and government) and intermediate users (firms and investors) as well as exports.
- Within the aggregate imports and domestic versus import (of household, government, firms and investors), the Armington assumption of imperfect substitutes is used to determine from which source the imports will come from.
- The model accounts for greenhouse gas emissions from fossil fuel combustion. Taxes can be applied to emissions.

DYNAMICS

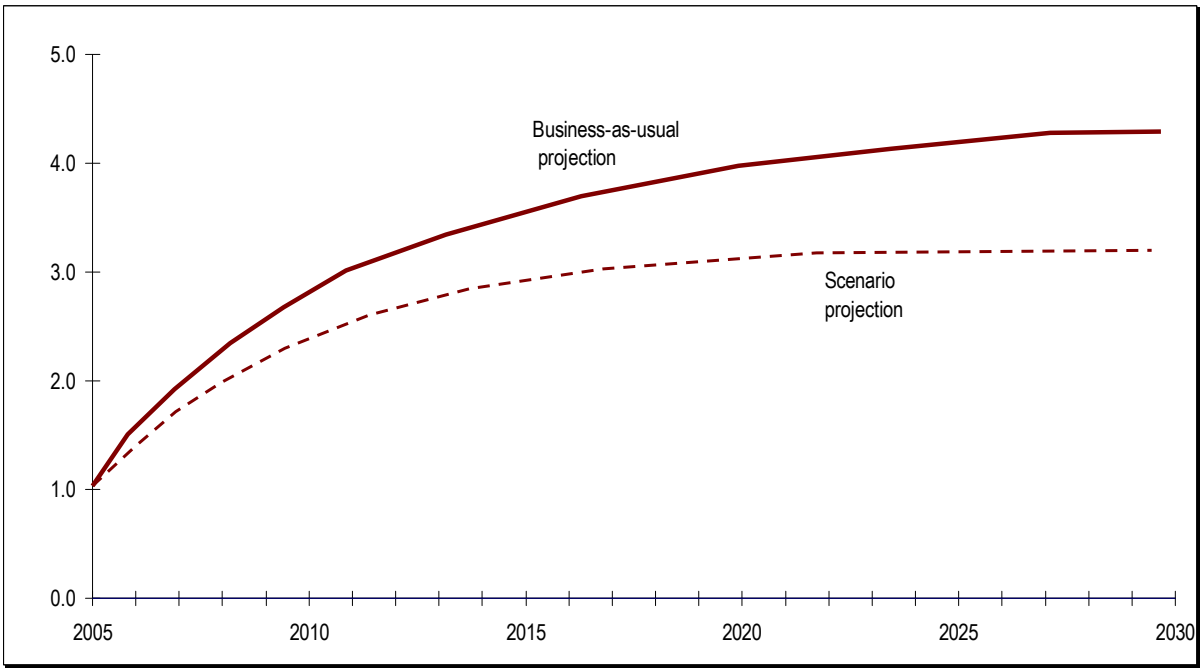
It is a recursive dynamic model that solves year-on-year over a specified timeframe. This has two main advantages. First, dynamics allows a richer specification of the model in that issues such as debt accumulation (which facilitates the ability to model international capital flows) and labour market dynamics are able to be modelled in a more sophisticated manner. Second, scenario analysis using a model such as AE-GEM can be greatly enhanced by the ability to alter the baseline, or reference case, to account for key developments or uncertainties.

The model is then used to project the relationship between variables under different scenarios, or states of the world economy, over a predefined period. This is illustrated in the chart below. This shows that a reference case, or 'business-as-usual' scenario forms the basis of the analysis undertaken using AE-GEM. The model is solved year-by-year from time 0 which reflects the base year of the model (2001) to a predetermined end year (in this case 2030).

The 'Variable' represented in the figure could be one of the hundreds of thousands represented in the model ranging from macroeconomic indicators such as real GDP to sectoral variables such as the exports of aluminium from Victoria to the Rest of the World. In the figure, the percentage changed in the variables have been converted to an index (= 1.0 at time 0) and is projected to increase by 2030.

Set against this reference case scenario is, in the figure below is a 'Scenario projection'. This scenario, in this example, represents the impacts of the Alcoa investment that results in a new projection of the path of the variable over the simulation time period. The impacts of the policy change are reflected in the differences in the variable at time T. It is important to note that the differences between the reference case and policy scenario are tracked over the entire timeframe of the simulation.

DYNAMIC SIMULATION USING AE-GEM



BASE DATA

The base data of the model is derived from the Global Trade Analysis Project (GTAP). GTAP produces a global database for general equilibrium modelling used by over 700 researchers worldwide. The Australian component of the database is provided by the Productivity Commission, and is based on Australian input-output tables produced by the Australian Bureau of Statistics.

The model is primarily based on input-output or social accounting matrices, as a means of describing how economies are linked through production, consumption, trade and investment flows. For example, the model considers:

- Direct linkages between industries and countries through purchases and sales of each others goods and services.
- Indirect linkages through mechanisms such as the collective competition for available resources, such as labour, that operates in an economy-wide or global context.

AE-GEM is based on the Version 6.0 pre-release of the GTAP database. This has a 2001 base year with 87 countries and 57 industry sectors. Of course, not all regions and sectors are relevant to this exercise, so the database is aggregates to the 38 sectors shown in the following tables.

SECTORS IN AE-GEM

Number	Description	Number	Description
1	Crop based agriculture	22	Electronics
2	Forestry	23	Other manufacturing
3	Animal based agriculture (incl. fishing)	24	Electricity
4	Coal	25	Gas distribution
5	Oil	26	Water distribution
6	Gas	27	Construction services
7	Other minerals	28	Trade
8	Processed agriculture	29	Road and rail transport
9	Textiles	30	Water transport
10	Wearing apparel	31	Air transport
11	Leather products (incl. footwear)	32	Communications
12	Wood and wood products		Fixed voice
13	Pulp, paper and printing		Mobile voice
14	Petroleum products		Fixed data
15	Chemicals, rubber and plastics		Mobile data
16	Nonmetallic minerals	33	Other financial services
17	Iron and steel	34	Insurance services
18	Nonferrous metals	35	Other business services
19	Fabricated metal products	36	Other services
20	Motor vehicles and parts	37	Government services
21	Other transport equipment	38	Ownership of dwellings

REGIONS IN AE-GEM

Number	Description	Number	Description
1	Australia	9	China
2	United States	10	India
3	Canada	11	South Korea
4	Japan	12	Other Asia
5	Europe	13	Middle East
6	Former Soviet Union	14	Africa
7	Eastern Europe	15	South America
8	New Zealand	16	Rest of the World