NEW ZEALAND INSTITUTE FOR THE STUDY OF COMPETITION AND REGULATION INC.

The State of e-New Zealand: 2004

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Executive Summary

This *State of E-New Zealand* paper revisits the relative international measures of New Zealand's preparedness to utilise and capitalise upon the economic and social benefits promised by the use of technology. In the previous paper[1], the authors concluded that New Zealand remained at the forefront of practically all electronic infrastructure indicators measured. Four years from the initial findings, this paper concludes that New Zealand's relative ability to use its infrastructure to gain productive advantage is decreasing. Although it is well prepared in infrastructure, New Zealand has slipped from its early leadership position relative to other countries in many as the information and communication technology market indicators, as the New Zealand market approaches maturity and other countries catch up.

Specifically, this report finds that:

- New Zealand follows international trends of slowing growth for fixed line telephony connections and in particular exhibits very low uptake of second lines, probably as a consequence of the availability of mobile telephony at reasonable prices relative to the price of a second line.
- New Zealand has high penetration of mobile telephony, which shows signs of a maturing market. Although mobile telephony prices are higher than other comparable countries such as Australia, this does not appear to have affected uptake of the technology.
- New Zealand continues to exhibit high numbers of Internet users. Notably, the advantage over Australia in this key indicator appears to have been sustained.
- Business uptake of broadband in New Zealand appears to be amongst the highest in the world, when accounting for the size of businesses.
- Residential uptake of broadband in New Zealand has been much slower than both business uptake and total broadband uptake in other countries. A possible explanation for low residential uptake may be the zero local telephony usage charge for dial up connections, and the high quality of dial up services for residential customers relative to that in other countries. Changes in the competitive environment following the Telecommunication Commissioner's recommendation on local loop unbundling in December 2003 that Telecom make available a limited bitstream product in the residential market may go some way to addressing the residential deficit.
- New Zealanders continue to enjoy high levels of access to computers.

[1] Howell & Marriott 2001.

- The growth of Internet hosts has stabilised. Internet indicators again reveal that New Zealand is following international trends of early adopters and reaching a maturing Internet market.
- The growth of active website numbers has stabilised, suggesting that the business market is saturated and growth opportunities are limited.
- Domain name registrations continue to increase, indicating continued awareness of the potential to use web identities. However, it is difficult to determine what this means in terms of business usage, as many domain names are inactive, and there is likely an increase in the number of individuals and firms reserving domain names in order to protect against future deprivation of identity
- The number of secure servers is increasing, indicating growing volumes of e-commerce activity within New Zealand.
- The use of e-banking is increasing. Whilst much of this growth is substitution from existing face-to-face and telephone banking, it is an indication that many customers place a significant positive value on the convenience offered, in addition to the lower transaction costs that the technology offers banks.
- New Zealand is well positioned to utilise new technology as education institutions and industry proactively provide training in science and technology.

New Zealand appears to have sufficient levels of infrastructure availability and connectivity to encourage uptake of information and communication technologies. Furthermore, usage figures in selected sectors such as banking are encouraging. Overall, this suggests the potential to gain productivity advantages remains high.

However, residential uptake of high-speed Internet connections continues to be slow. Given the high levels of all other indicators, this solitary metric appears as an anomaly. Using the systemic interaction of all of the connectivity, capability and uptake characteristics, it suggests that the applications that utilise these technologies either are not available, or are not valued sufficiently to justify their expense at current prices, relative to the other items to which household spending are directed. Whether this is of significant concern in respect of overall national benefit is difficult to discern at the present point in time.

Table of Contents

Table of Figures

Introduction

This paper is the third in a series of papers published by the Institute for the Study of Competition and Regulation that documents measures of the performance of New Zealand's 'electronic economy'. Whilst information has always been a fundamental component of economic activity, the emergence and increasing use of telephony, computers and digital information exchange infrastructures such as the Internet have brought with them an increasing emphasis upon the ways in which information and its uses contribute to the creation of wealth and welfare in an economy. As Perelman states:

> *"The real information revolution is not that information is suddenly becoming important. Information has always been important. The revolutionary aspect of the information age is the treatment of information as a commodity in ways that would have been unimaginable only a few decades ago."*[2]

In the past, it has been difficult to measure the effect that an intangible commodity such as information may have had in wealth and welfare creation. However, the emergence of electronic technologies such as computers and the Internet have had a two-fold effect. Firstly, they have lowered the costs of some activities, making tasks that were once impossibly expensive now affordable, thereby increasing the welfare of individuals by whom these applications are valued. Secondly, they have made the use of some forms of information in this process, if not actually measurable in themselves, at least more traceable than was previously possible. This has enabled analysts to attribute the source of welfare gains more accurately. Together, these effects have led to the belief that the information economy based upon these electronic technologies offers access to a new source of wealth and welfare creation, and the attendant concept that relative 'electronic enablement' stands as a benchmark of how well respective nations have captured the wealth and welfare gains on offer. Indisputably, it has led to a new industry of analytical endeavour to measure relative success and predict future gains. This document forms part of that endeavour.

Since the last paper was published in 2001, more data about the utilisation of electronic technologies throughout the world has become available. Examples include the *OECD Communications Outlook 2003*, the National Office for the Information Economy (NOIE)'s *Current State of Play 2002*, and various reports by the International Telecommunication Union (ITU). This enables comparison of New Zealand's performance against other OECD countries.

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[2] Perelman 1998, p 4.

In the first paper[3], the authors proposed that unless any evidence can be found to the contrary, world leadership by New Zealand in infrastructure measures indicates a world-leading position in preparedness and potential to access the benefits offered by new methods of trading in an information-based economy. The second paper[4] further proposes that, in the absence of a single indicator that measures the welfare gains from the use of electronic processing and communication technologies, if interrelated infrastructure indicators consistently lead to the same conclusion, this provides more a meaningful basis for presuming that use of the technologies will lead to increases in welfare than taking any individual indicator in isolation. Moreover, the paper proposes that it is utilisation of the infrastructures, rather than physical connection alone, that provides the best proxy for the extent of those welfare gains. Welfare gains are determined by the use of applications that in turn create derived demand for both access to, and utilisation of, infrastructure. Welfare-enhancing selection and utilisation of applications, however, requires complementary investments in learning. Without investment in learning, even when applications and infrastructure are available, welfare gains will be less than optimal and capital may lie idle or underutilised while learning occurs.

Following on from the previous two papers, the current paper utilises Howell's dynamic framework[5] that addresses not only connections to infrastructures but also other factors in the market that affect infrastructure buyers' behaviours, such as the availability of applications and human capital that utilise the infrastructure, and the extent of utilisation. The thesis is that it is the interaction of these elements that leads to the sector's overall performance, which is measured in this paper relative to that of other countries. As with the previous reports, the focus is on comparison with OECD countries, particularly Australia. In addition to benchmarking New Zealand in the identified metrics, this paper also comments on the progress and significant changes observed in the three years since the last report. Consistent with past reports, this paper also attempts to provide some interpretations and explanations for observations that draw upon the environmental and contextual factors in New Zealand and the key comparator countries.

The paper is organised into four main sections: connectivity, capability, uptake and performance, corresponding to the main drivers and indicators identified in Howell's framework. Each driver has numerous proxy measures that can inform its level of impact on

3 Boles de Boer et al 2000.
4 Howell & Marriott 2001.
5 Howell 2001.

overall performance. Two broad connectivity measures are telecommunication infrastructure access and Internet indicators. Each of these have various factors, such as availability of fixed line telephony, number of mobile connections, Internet access, availability of broadband, and relative price comparisons, that can determine the impact of infrastructure on uptake of new technology.

Capability is the second major input in the performance equation and is measured using proxy values of ICT hardware availability, human capability and individual skills. Together, these enable uptake of the available technology.

This paper measures uptake by analysing actual data of electronic banking usage and usage of computers for personal and business use to determine the level of interaction between capability and connectivity. Uptake is a proxy measure to reflect the potential gains from use of technology.

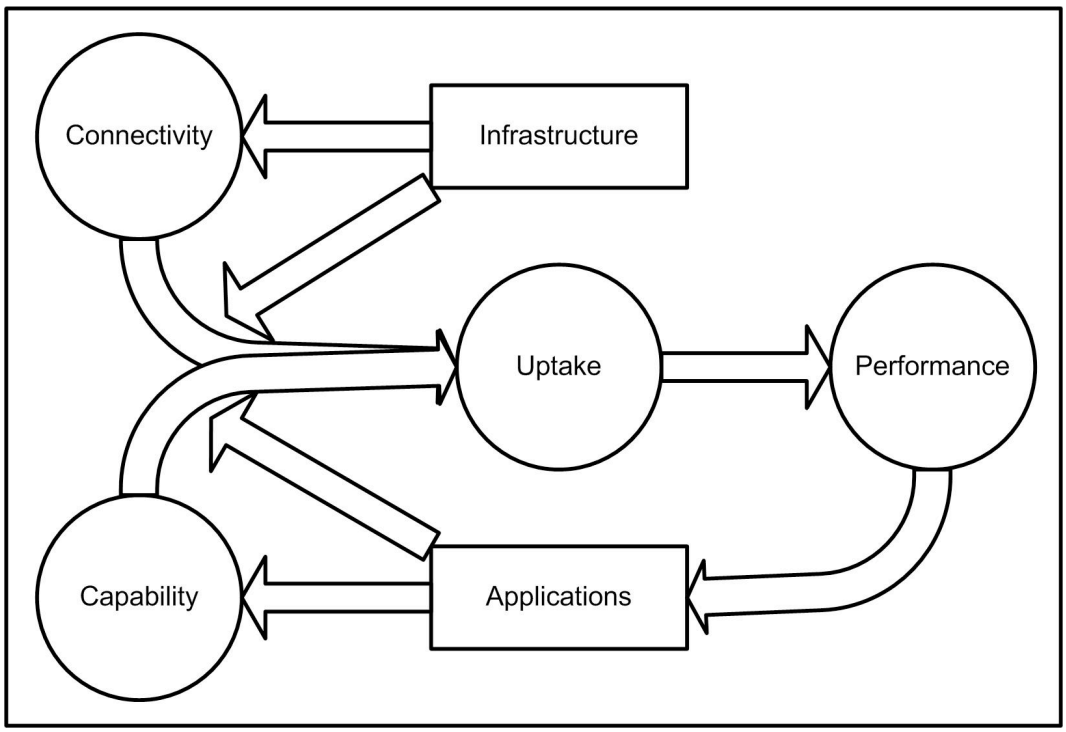
Productivity is arguably the most comprehensive indicator of an economy's cumulative performance.[6] Previous papers acknowledge that productivity is hard to measure. However the proxy measures taken together provide a broad picture of the direction of New Zealand's performance, both in the absolute and in comparison with other countries. If the proxy measures taken together are consistently better than those of the international comparator countries, then New Zealand's relative productivity performance (or potential performance in the future) can be presumed to be is better than the international benchmarks. The first two papers suggest that New Zealand has enjoyed an absolute advantage over most OECD countries, including Australia, so might therefore be presumed to have either a better performance, or the potential for a better performance. However, if the gap between New Zealand and other countries closes, this implies that New Zealand's past advantage is becoming smaller. A reducing gap implies new challenges for New Zealand, especially given the government's vision for New Zealand returning to the top half of the OECD in respect of national economic performance.

[6] Howell 2001, p 66.

Methodology

The State of E-New Zealand: 2004 provides a broad 'snapshot' of the country's ability to gain relative increases in welfare through utilisation, investment and growth opportunities of current information and communications technology (ICT) in New Zealand. This paper uses Howell's framework, depicted in Figure 1, to study the state of e-New Zealand.

Figure 1. Howell's Framework



Source: Howell 2001.

Howell's framework separates out infrastructure, which enables connectivity, from uptake (usage) and allows a systemic analysis of factors that enhance performance. It measures infrastructure penetration and capability to utilise applications as proxies for the likelihood that welfare gains are being generated from the use of technologies. Specifically, it recognises that welfare gains will ensue from increased connectivity only if two conditions are met: the complementary investments in capability have been made and applications are available that generate increased returns to consumers over and above the existing activities that these consumers choose to utilise. Thus, uptake statistics offer the best proxy for potential welfare gains from a technology. Connectivity alone is insufficient to ensure that welfare gains ensue.

Business consumers will utilise new infrastructures and applications only if, by using them, it is possible to generate greater returns from the use of available resources (capital and labour)

than is possible from alternative uses of these same resources. Residential consumers will utilise new infrastructures and applications only if they receive a greater benefit from using them than is available from the consumption of alternative products available within their budget constraints. That is, for a given level of consumption, they must experience a rise in utility – a productivity gain – for utilisation to occur. Without the infrastructures and applications, no gains are possible. Likewise, without the welfare gains from actual utilisation, connectivity offers no benefit. It is only by analysing supply and demand together in this manner that connectivity statistics take on a meaningful context.

Howell's framework identifies that demand for infrastructure is primarily underpinned by the existence and use of welfare-raising applications. Demand for infrastructure is determined by demand for utilisation of the applications and thus is a derived demand. Supply-side infrastructure availability will increase welfare only if welfare-raising applications are present, along with the requisite capability to use both these applications and the infrastructure together. Applications are therefore both necessary and sufficient to stimulate welfare-raising demand for infrastructure. Infrastructure is necessary to enable these gains to be made, but not sufficient on its own.

Connectivity

Connectivity is comprised of measures of the numbers of individuals, households and businesses that have purchased connections to specific infrastructures and hence have the capacity to exchange information electronically. Whilst connections are necessary to accrue welfare gains from electronically-mediated information exchange and processing, measures of the number of connections in isolation is a poor proxy for the accrual of welfare gains. Rather, connections stand as a measure of the potential to accrue gains, given the requisite welfare-raising applications and capability to deploy the applications exist. Inter-country comparisons of infrastructure connectivity therefore provide an incomplete picture of the potential welfare gains available from a technology.

Measured connectivity levels are influenced by both demand for the value created by the underlying applications that utilise the infrastructure and the prices at which the connection is made available. That is, a consumer will purchase a connection only if the benefits of doing so exceed the costs associated with the connection. Thus, the emergence of a new technology will not result in its uptake by default – the consumer's cost-benefit analysis must be positive for purchase and utilisation to ensue. Computers and connection to telephony services lie at the core of electronic information processing and exchange connectivity measures. However, alone they measure only the potential to gain benefit – actual benefit accrues only when the connection is utilised.

This report uses the following indicators to measure connectivity:

- Fixed telephone lines – allow connection to voice and data exchange applications;
- Mobile penetration – indicates the ability of consumers to be connected to a telephone network other than a fixed telephone line;
- Internet access – reflects the ability of consumers to access the World Wide Web. This is measured in terms of Internet users per 100 inhabitants, Internet users per host and percentage of computers connected to the Internet;
- Broadband access – enables faster speeds than telephone lines to upload or download information from the World Wide Web;
- Leased lines – telephone lines that are leased from the incumbent infrastructure provider to provide competitive products and services using the same infrastructure;
- Other Internet indicators – include the number of Internet hosts, websites, domain name registrations and secure servers.

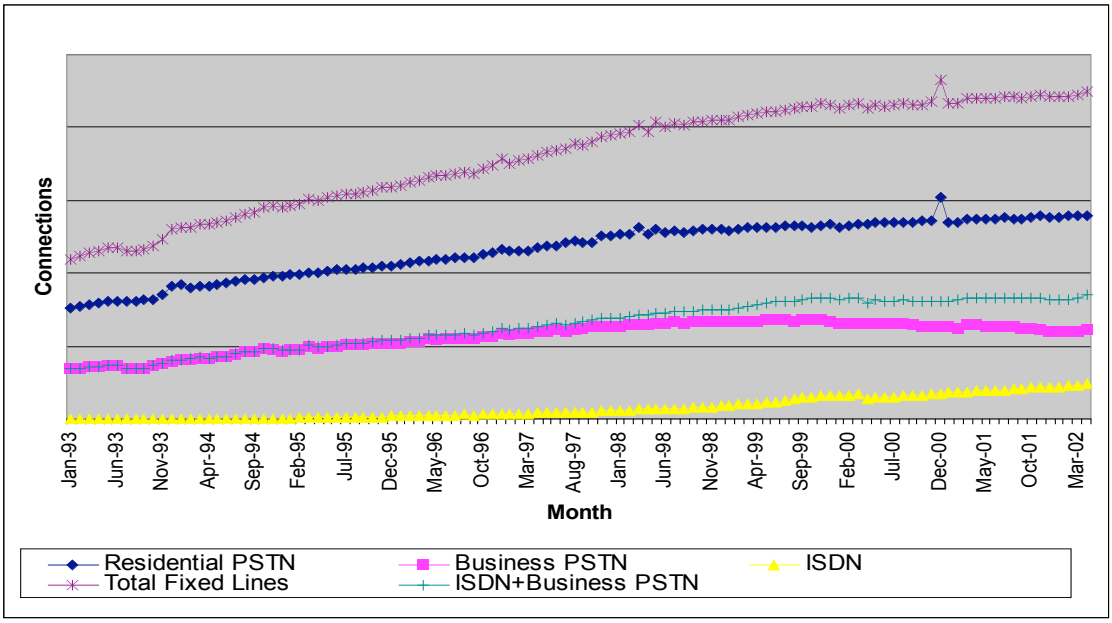
Telecommunications Access

Telecommunications access pertains to the availability of different types of connecting options within a country. Basic telecommunications access is deemed to be fundamental to the development of an information economy, as it is the infrastructure over which information (voice and data) has been transferred. New Zealand had improved its rating for total telecommunication access paths (fixed and wireless)[7] from 81.0 per 100 inhabitants in 1999 to 108.8 in 2001, thereby exceeding the OECD average of 108.2 in 2001.[8]

Fixed Lines

Fixed telephony lines are seen as an important connectivity factor, as they provided the foundation for initially voice, telex and fax connections, basic Internet access via dial-up services, and provide the basis for DSL broadband services. The demand for fixed line access in New Zealand appears quite stable. Growth in the absolute numbers of connections has slowed considerably since the beginning of 2000. Figure 2 shows the total number of fixed line connections in New Zealand, displaying continued growth (average 0.66% per month) over the entire period, but considerably slowing since the beginning of 2000 (average 0.21% per month).[9]

Figure 2. New Zealand Fixed Lines[10]



Source: Howell & Obren 2003.

[7] Includes fixed access lines and cellular mobile subscribers.
[8] OECD 2001, p 81 and OECD 2003, p 103.
[9] Howell & Obren 2003, p 23.
[10] Connection numbers on the Y-axis in this graph have been suppressed for confidentiality reasons.

Figure 2 also reveals since the middle of 1999, the number of business Public Switched Telephone Network (PSTN) lines has been falling from a peak in April 1999. However, the total number of busines lines has been approximately stable, due to an increase in the number of ISDN lines. The substitution of PSTN lines with ISDN has presumably been due to changes in pricing and the greater range of services available via ISDN connections. Growth in the number of residential lines began slowing from the beginning of 1998. Figure 3 shows that the number of residential connections has grown no faster than the growth in the number of households in this period.

The results of statistical tests on the growth of each of the residential, business and total connections imply a very mature fixed line market with few growth possibilities.[11] This tends to indicate a mature fixed line market. Internationally this is not unusual, as many other markets have experienced low or even negative fixed line growth over a similar period (Figure 4). For example, Belguim, Canada, Finland, Iceland, Japan, Korea and the United States all registered negative fixed line cumulative average growth rates (CAGR) over the period 2000-2001. New Zealand's CAGR over the same period is lower than that of Australia, France, Germany, Ireland, Luxembourg, the Netherlands, Spain and Switzerland, but is comparable with that of the United Kingdom.

Fixed Line Diffusion per Household

Whilst the New Zealand data shows an overall diffusion rate of approximately one residential telephone line per household, survey data (Figure 5) indicates that only around 93% of New Zealand households have a fixed telephone line. This is lower than Australia (97%), South Korea (99%) and Norway (100%), comparable with the United States and the United Kingdom (94% each), but higher than France (90%) and Ireland (84%). Given the very low growth rates in fixed lines, it appears that, for varying reasons, a greater number of New Zealand households are chosing not to have a fixed line connection than in Australia. However, the New Zealand pattern is not very different from that in other comparactor counttries the United States and the United Kingdom. Figure 5 also shows that the number of New Zealand households with more than one fixed telephone line is lower in New Zealand (8%) than in Australia (11%), Hong Kong (13%), Norway (20%) and the United States (29%). However, it is greater than the United Kingdom (7%), Sweden (6%), France (5%) and South Korea (1%).

[11] Howell & Obren 2003, p 23-24.

Figure 3. New Zealand: Total Connections Per Household

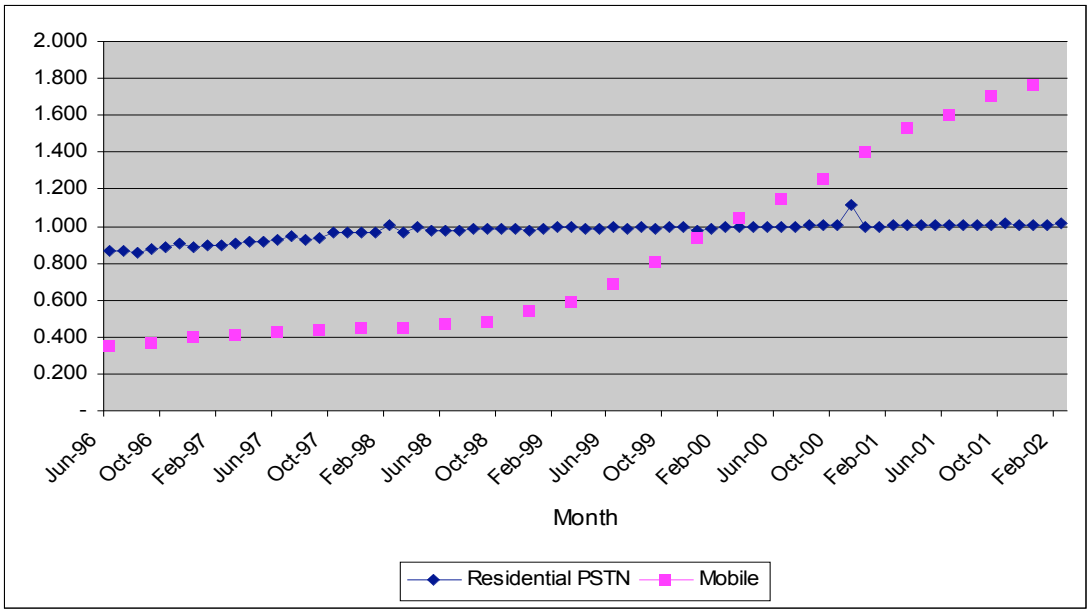
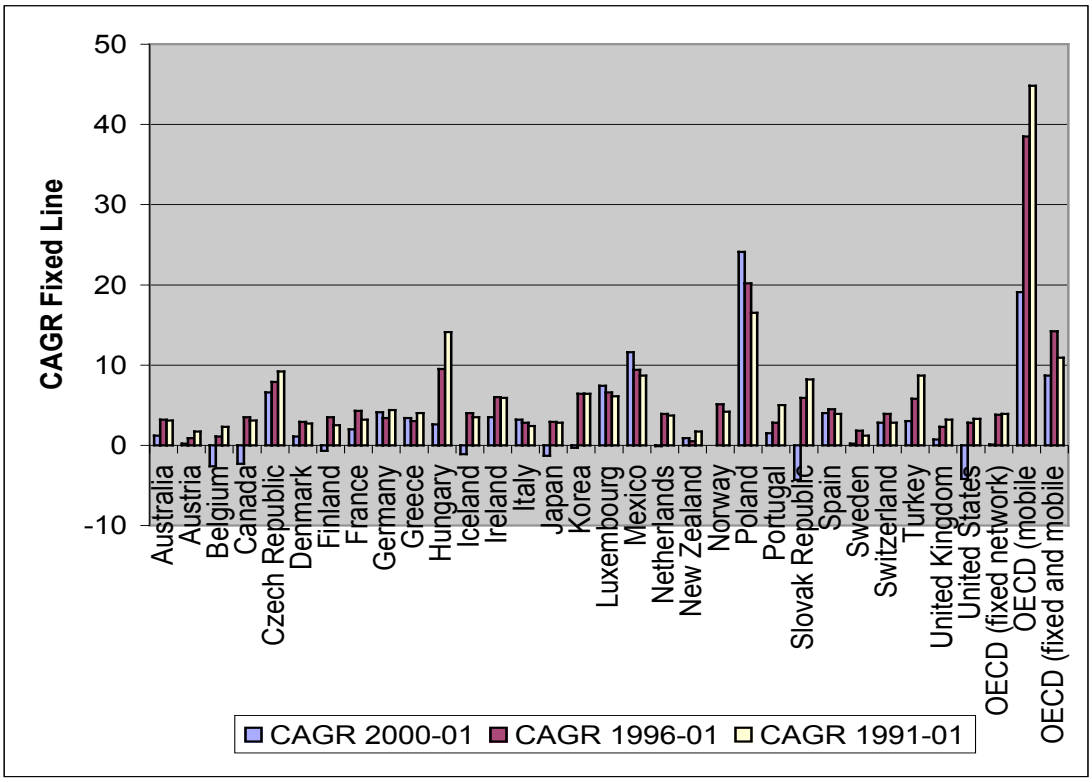


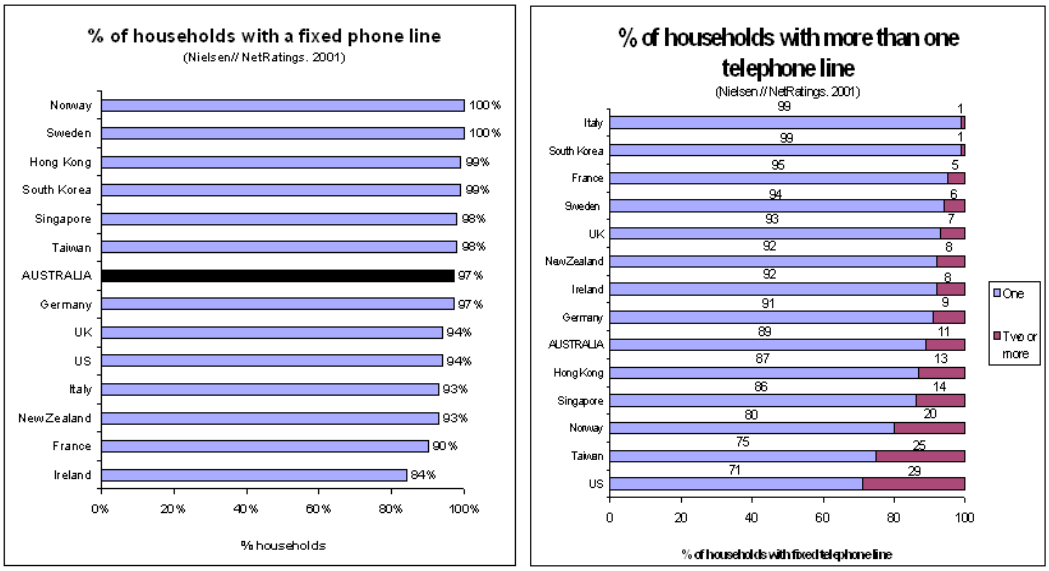
Figure 4. Fixed Line Cumulative Average Growth Rates



Source: OECD 2003.

It has been suggested (Merrill Lynch, 2002) that in many countries, purchase of second lines is linked to the use of dial-up Internet access, and that the decline in the growth of fixed line accounts is aligned with an increase in the use of alternative technologies to access the Internet, such as DDSL, wireless and cable. This appears consistent with declines in countries such as the Netherlands, Switzerland, the United States, Austria, Germany and Belgium. However, there is still a large absolute number of residual multiple lines in countries such as the United States. The New Zealand figures imply that whilst second lines are not an insignificant component of total residential fixed telephony lines, the attribution of decline in growth rates to substitutions away from dial-up Internet access is less robust in the New Zealand context. This will be discussed subsequently.

Figure 5. Households with Fixed Telephone Lines 2001



Source: National Office for the Information Economy 2002.

Fixed Line Diffusion per Capita

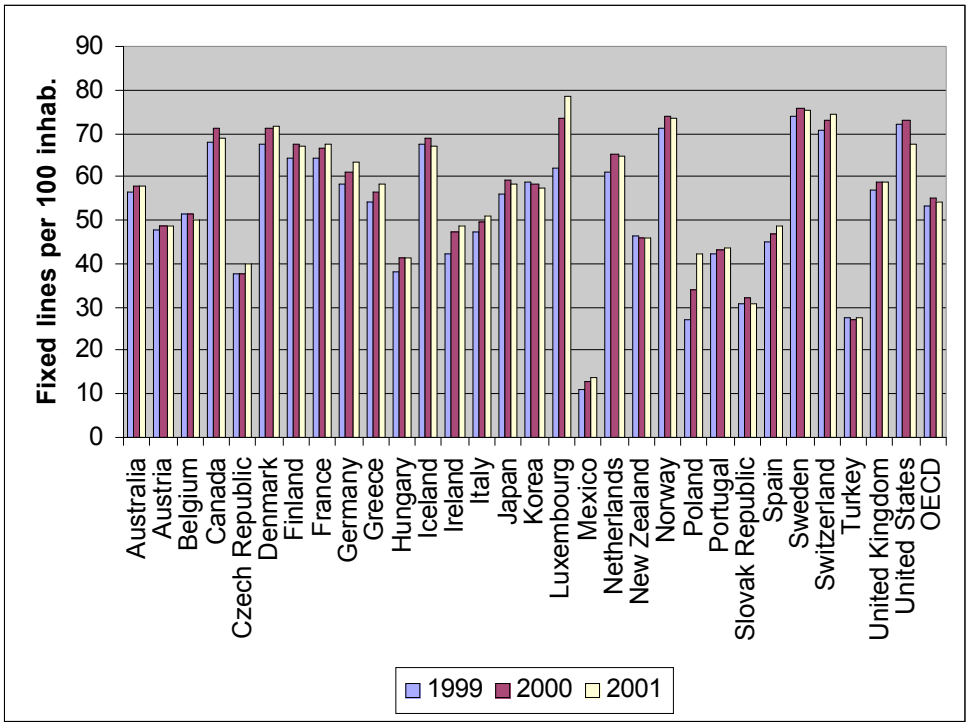
In keeping with lower numbers of fixed lines per household, New Zealand also exhibits a lower number of fixed lines per capita than comparator countries Australia, Canada, the Nordic countries, Denmark, France, Germany, Greece, Japan, Korea, Luxembourg, Switzerland and the Untied States in the period 1999-2001 (Figure 6). New Zealand's fixed line diffusion per capita in 2001, whilst slightly less than the OECD average, is similar to that of Austria, Belgium, Ireland, Italy and Spain.

Diffusion per capita is also stable, a pattern exhibited by Australia, Austria, the Nordic countries and the United Kingdom. Fixed line diffusion per capita is decreasing in Canada,

Iceland, Japan, Korea, and the United States. Overall, the OECD average shows a slight decrease. Indeed, significant growth in this metric is occurring only in only a handful of European countries, including France, Germany, Greece, Luxembourg, Poland, Spain and Switzerland, and Mexico.

The international evidence would appear to confirm that fixed line telephony is now entering its declining stages in the more mature markets as consumers switch away from fixed line to alternative connections (e.g. mobile, alternative Internet access). New Zealand, with stable per capita and per household diffusion rates, appears to be positioned at the cusp. It is neither a leader nor a laggard in the diffusion life cycle of this product.

Figure 6. Fixed Lines per 100 Inhabitants 1999-2001



Source: OECD 2003.

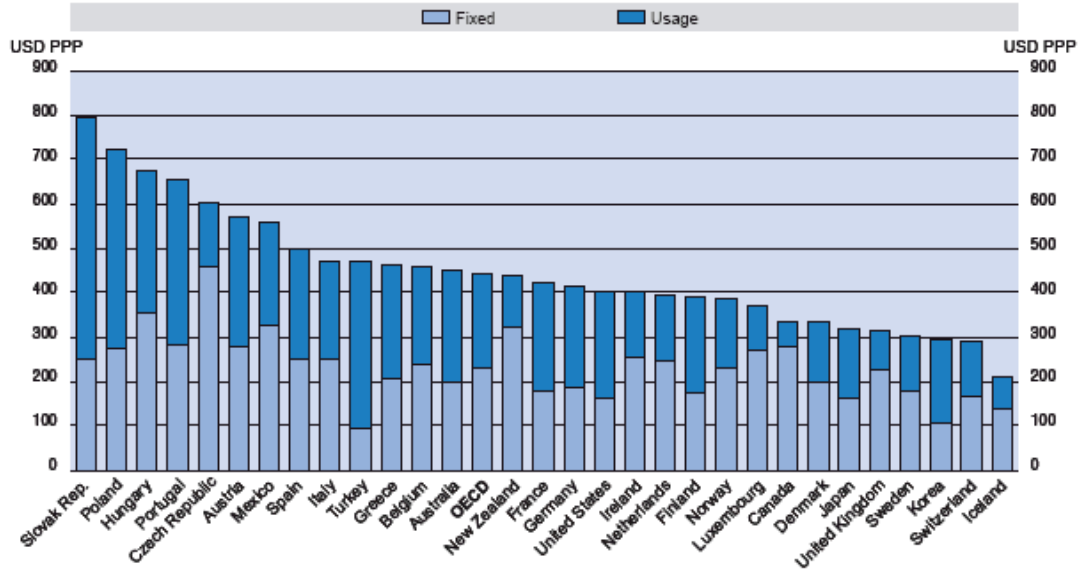
Fixed Line Prices

New Zealand's residential fixed line tariffs are, using the OECD basket of access charge and local and long distance calls, whilst higher than the United States, the United Kingdom, the Nordic countries and South Korea, are slightly below the OECD average and less than those in Australia (Figure 7). However, as the New Zealand residential telephony market is characterised by the Telecommunications Service Obligation (formely the 'Kiwi Share') that requires the incumbent fixed line provider Telecom New Zealand to offer a residential tariff

with no usage charge for calls placed within a local calling area. Whilst unbundled access and usage tariffs have been available since the mid 1990s, the zero usage charge tariff continues to be the most popular residential tariff. As the tariff 'bundles' the connection charge with the usage charge, it is difficult to make accurate comparisons of prices between New Zealand and other jurisdictions where usage charges apply. As most New Zealanders face a zero local call charge, they tend to make more local calls on average than the OECD basket allows for. Thus, New Zealand's position in the OECD comparison would tend to indicate a higehr cost per call than is actually the case.

Figure 7. OECD Residential Tariff Basket August 2002

(USD PPP incl VAT)



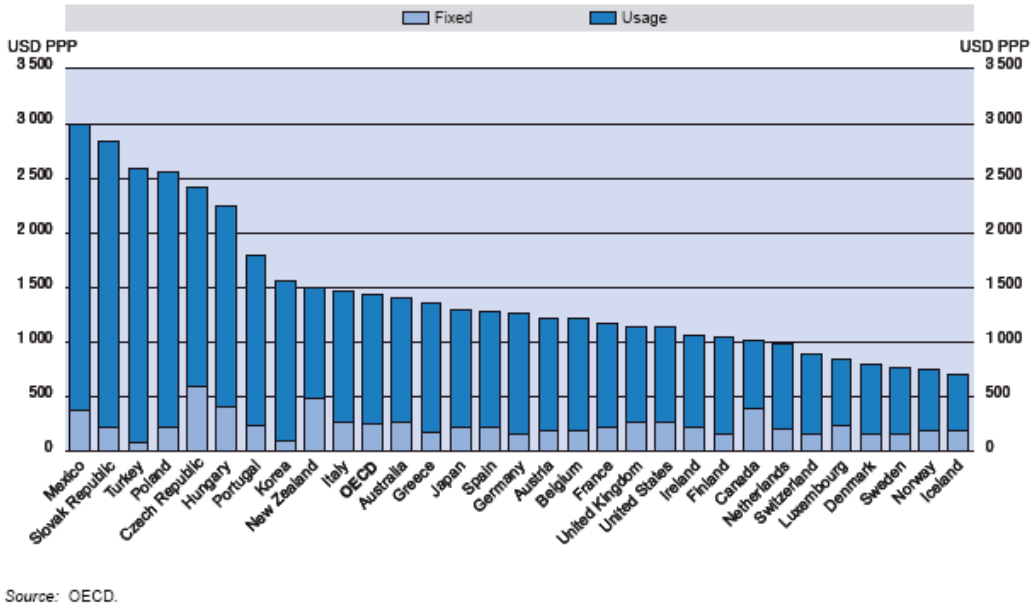
Source: OECD.

Furthermore, the popularity of the zero usage charge the tariff offers a potential explanation for why New Zealand's per capita and per household fixed line diffusion is lower than in many otherwise comparable jurisdictions. Second lines in New Zealand under the 'bundled' tariff have historically been relatively more expensive than second lines in jurisdictions where the prices for second lines reflect only the connection charge and not a additional 'averaged' usage charges. For example, the price of a second line from Telecom is 75% if the price of a primary line, compared to 25% for SBC in the United States. Thus, whilst the percentage of New Zealand households with a telephone is comparable with that of the United States (93% vs 94%), the proportion of second lines is very different (8% versus 29%).

The OECD basket for fixed line business tariffs, including local, long distance and international calls, and calls to moibile phones, shows New Zealand in a slightly less advantageous position, slightly more expensive than the same basket in Australia and the OECD average, and less than South Korea (Figure 8).

Figure 8. OECD Composite Business Telephony Basket August 2002

USD PPP excl. VAT



Source: OECD.

Summary

New Zealand appears to exhibit internationally competitive levels of connectivity to fixed line telephony services, at prices that are around the OECD average. Comparable to other mature fixed line markets, the New Zealand market is exhibting signs of reaching maturity as alternative Internet access methods become available. Whilst the diffusion of second lines is not as extensive as in other countries, this is partially explained by pricing of these services.

Mobile Connections

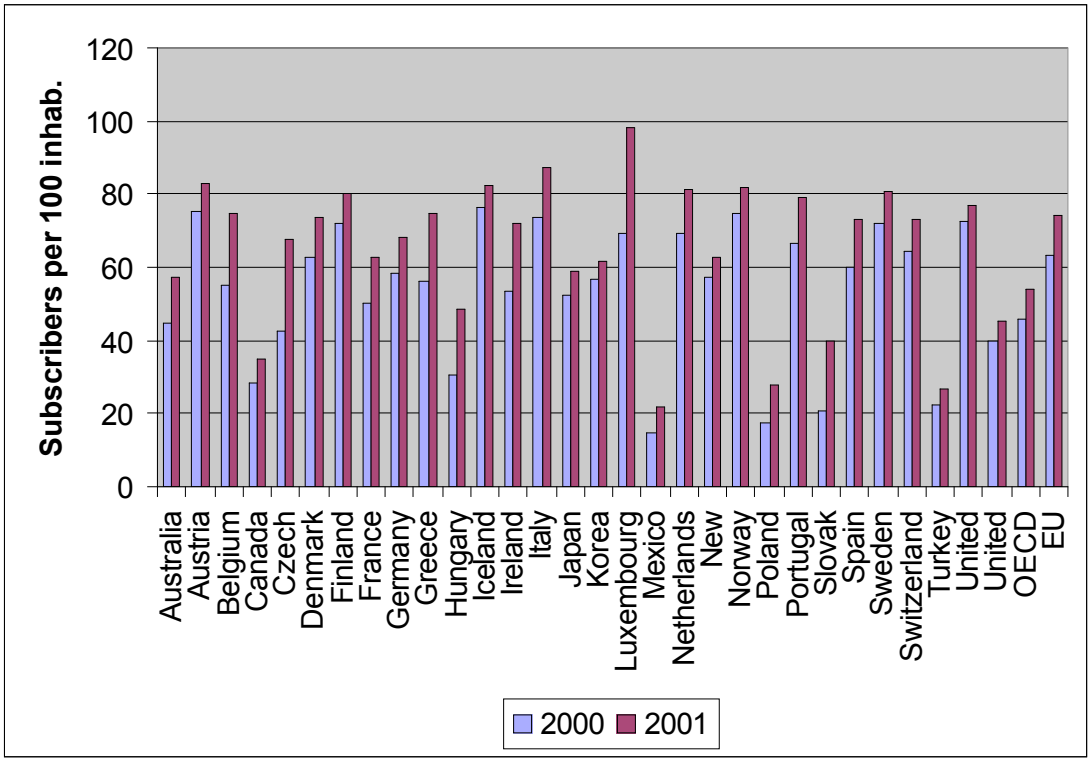
Mobile telephony both substitutes and complements fixed line telephony, in that it enables the exchange of information via both voice and data exchange. In 2001, New Zealand's mobile networks covered 97% of the population, slightly below the OECD average of 97.8%.[12] Basic access to fixed and cellular mobile had stabilised in countries with high penetration according to the *OECD Communications Outlook 2003*.

[12] OECD 2003, p 107.

Mobile Telephony Diffusion

New Zealand's cellular penetration continues to grow over time. As shown in Figure 9, New Zealand's cellular penetration was 62.9 per 100 inhabitants in 2001, considerably higher than that evidenced in Canada (34.9), the United States (45.1), the OECD average (53.9) and Australia (57.1), around the same level as South Korea (61.4), but lower than Luxembourg (98.0), the Nordic countries (between 73.9 and 80.5), the United Kingdom (77.1) and the EU average (74.3). The ITU reported New Zealand's mobile penetration as 61.8 mobile subscribers per 100 inhabitants in 2002[13], a figure comparable to that of the OECD.

Figure 9. Cellular Penetration – Subscribers per 100 Inhabitants



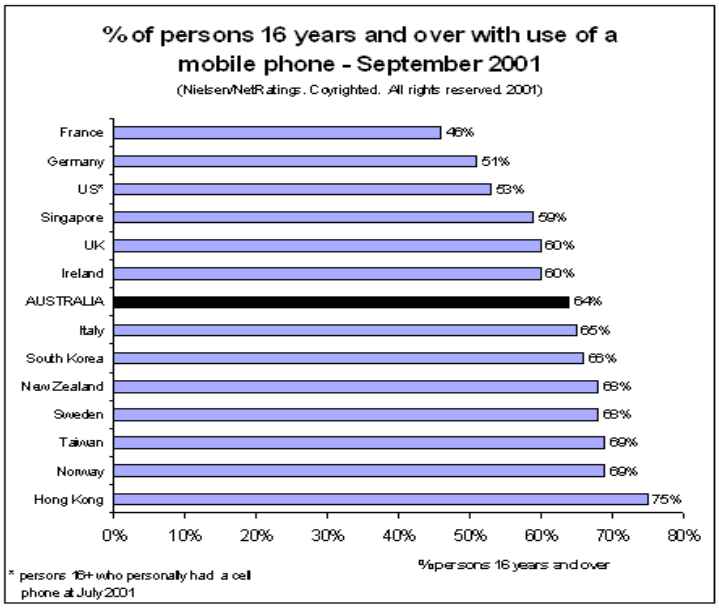
Source: OECD 2003.

The OECD data are reinforced by NielsenNet survey data in September 2001, showing 68% of people 16 years and over having the use of a cellphone (Figure 10), whilst in 2003, Howell and Obren (200) found the diffusion per capita over 10 years of age was over 70% (Figure 11). New Zealand exhibits a higher cellphone penetration in the NielsenNet survey than the United States (53%), the United Kingdom (60%), Korea and Australia (both 66%), the same as Sweden, but less than Norway (69%) and Hong Kong (75%). Thus, New Zealand's

[13] International Telecommunication Union 2003, p A-37.

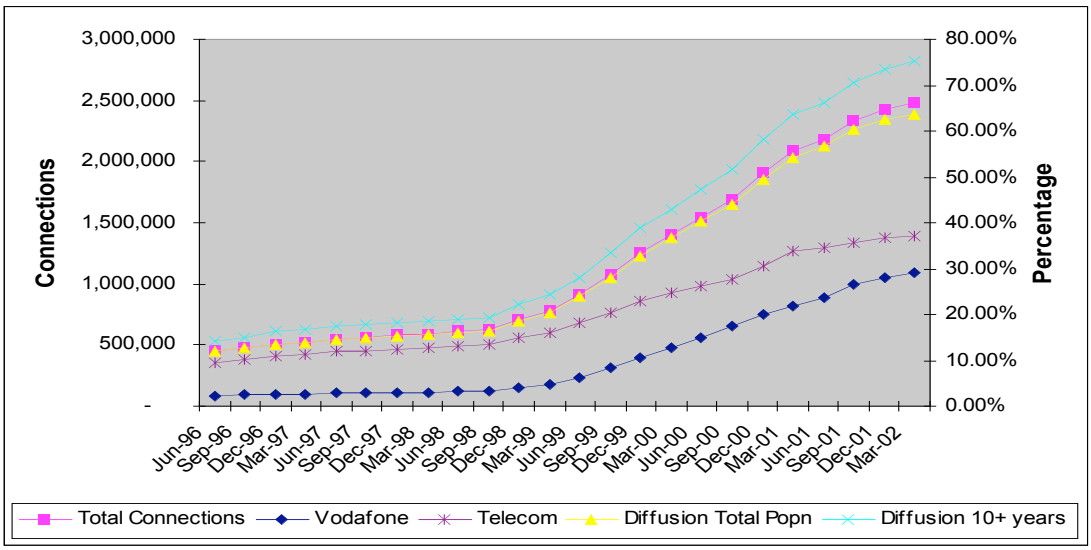
cellphone penetration levels appear to be internationally competitive. By September 2004, one provider alone, Vodafone New Zealand, reported a subscribership of 1.757 million, with a rise of 82,000 subscribers in the third quarter of 2004 (4.67% growth per quarter), and a market share of 56.2%, suggesting that New Zealand's total mobile subscribership is around 3.126 million[14]. Thus, penetration of mobile phones is now around 78 per 100 of population.

Figure 10. Persons with Use of a Mobile Phone



Source: National Office for the Information Economy 2002.

Figure 11. Mobile Uptake and Diffusion

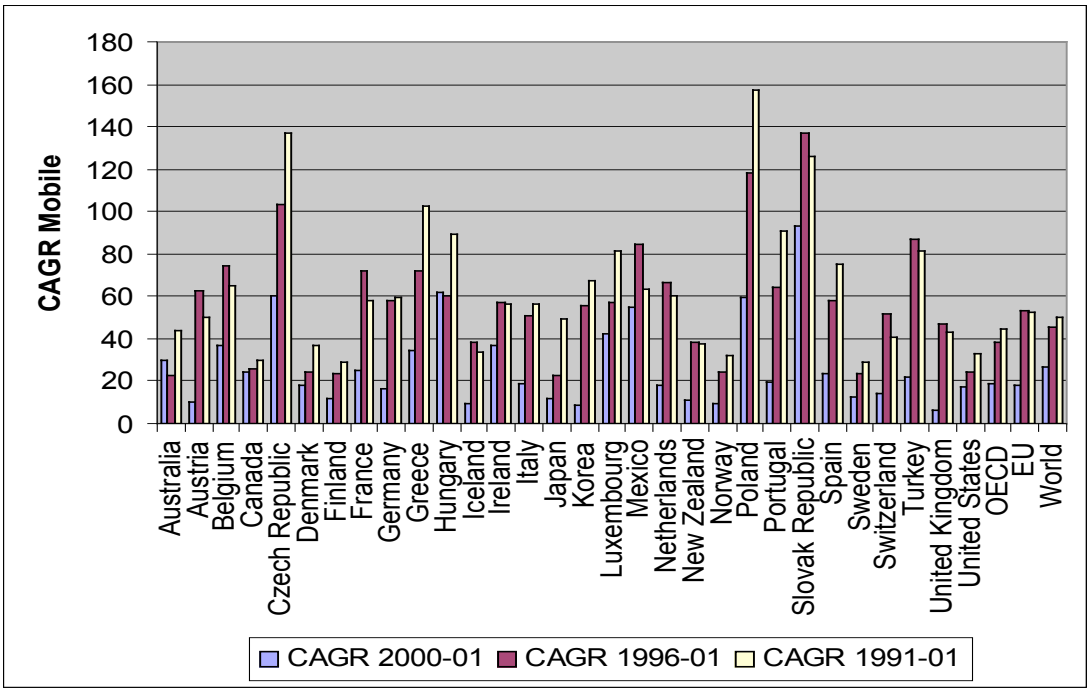


Source: Howell & Obren 2003.

[14] PriMetrica TeleGeography 2004.

Figure 11, combined with the OECD data (Figure 12) show that the cumulative average growth rate (CAGR) in mobile subscribers per 100 inhabitants in New Zealand from 2000 to 2001 has slowed to 10.2%, lower than the OECD average of 17.5%. Over the period 1996 to 2001 however, New Zealand maintained a growth rate (37.5%) close to the OECD average (37.4%). The slower growth rate between 2000 and 2001 indicates that the New Zealand mobile market is maturing more quickly, having had substantial growth earlier than Australia, which by comparison had a much lower CAGR from 1996 to 2001 of 21.3, but a higher growth rate of 28.3% between 2000 and 2001.[15]

Figure 12. Mobile Connection Cumulative Average Growth Rate



Source: OECD 2003.

Two possible explanations are offered for New Zealand's relative position in mobile telephony diffusion relative to other countries. Firstly, New Zealand's diffusion is greater than that in Australia and the United States, and more similar to that observed in Europe, partially due to the presence of prepaid mobile telephony. This option was first made available in New Zealand in 1998. Prepaid services are not widely offered in the Untied States, and have only recently been offered in Australia, but are commonplace in Europe.

New Zealand's penetration of prepaid cellular connections was at 68.6% of connections in 2001 (ranking it 8th highest of the OECD countries), an increase from 46.0% of connections in

[15] OECD 2003, p 105.

1998.[16] The reduced risk of unexpectedly high phone bills, particularly in the residential market, encourages uptake of this technology. The proportion of prepaid accounts provides some indication of the extent of residential, as opposed to business, use of the technology. Figure 11 shows that following the introduction of prepay accounts in 1998, the growth of mobile diffusion has been rapid, but with a stabilisation of mobile connection growth in recent months.

Secondly, in New Zealand, calls are paid for entirely by the calling party, rather than in part by the receiving party, as is the case in the United States and parts of Asia. This has increased the appeal of mobile phones for people wishing to be contacted, but not necessarily intending to make calls, whilst away from a fixed line. The two factors of prepaid accounts and calling party pays would thus appear to account for the significantly higher penetration of mobile phones in New Zealand than in the United States.

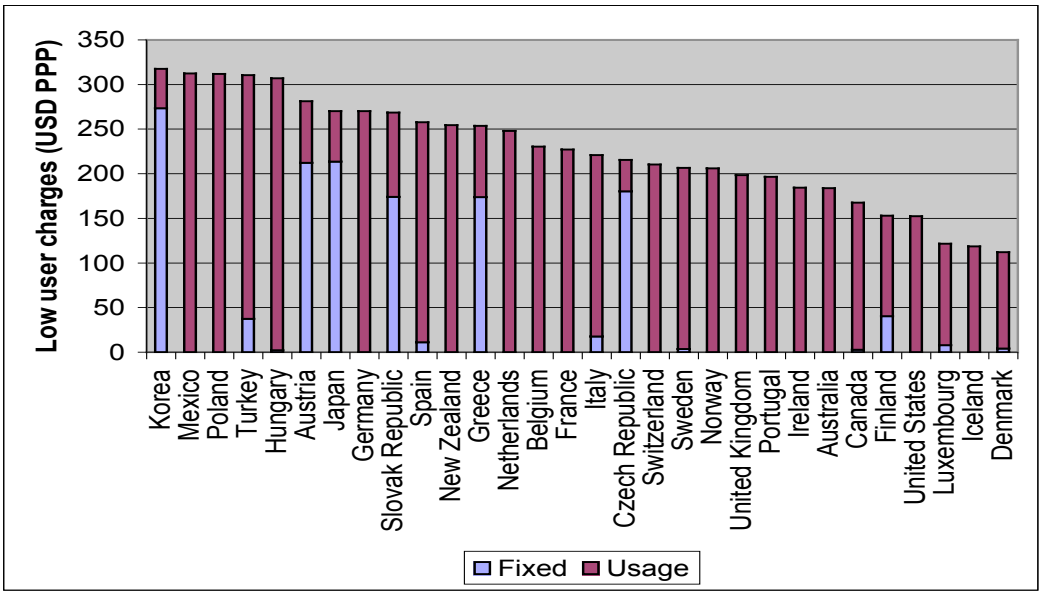
Mobile Telephony Prices

According to the *OECD Communications Outlook 2003* "the two major drivers of growth continue to be wireless communications and the Internet".[17] The report also points out that revenues for cellular mobile services have increased substantially in the last decade, reflecting considerable expansion of wireless access. In New Zealand, residential charges for comparable mobile services have experienced gradual increases in monthly access fees, gradual reductions in peak usage charges, while off-peak usage charges have remained fairly constant.[18]

The range of calling plans available to both residential and business mobile users, with various combinations of fixed and variable (call) charges, 'free' minutes and other services (for example, text messaging), has increased substantially, both in New Zealand and other countries. The wider the range of packages, the more likely it is that a consumer will be able to find a plan that offers the best value for money given the consumer's calling patterns. However, the range of bundles and plans makes benchmarking of prices between providers and countries extremely problematic. In order to overcome this problem the OECD benchmarks mobile prices using baskets that represent low, medium and high users. Figures 13, 14 and 15 compare OECD countries in each of these categories.

[16] OECD 2003, p 106.
[17] OECD 2003, p 13.
[18] Howell & Obren 2003, p 11.

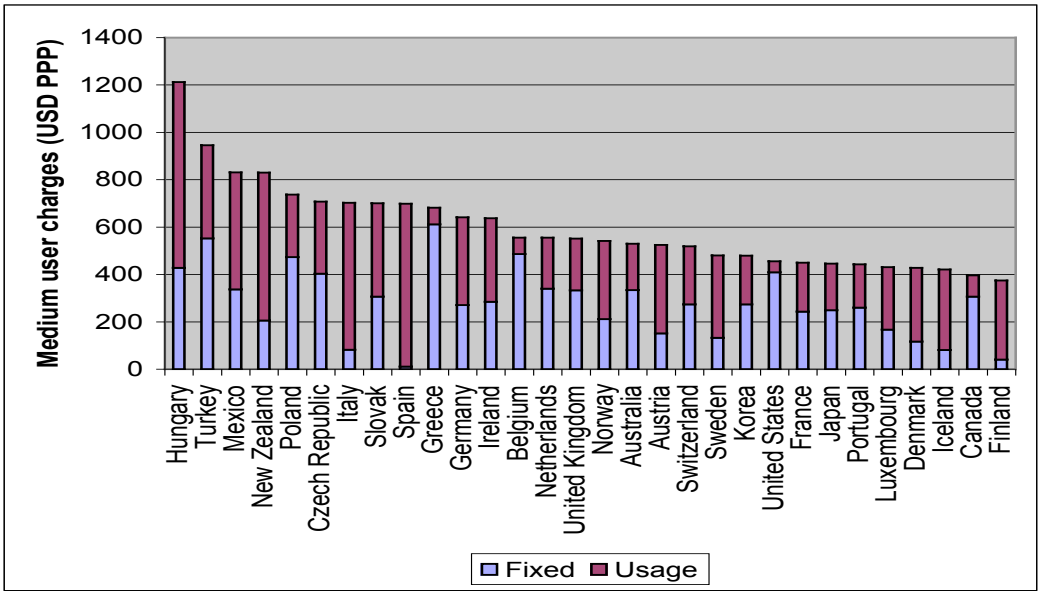
Figure 13. Mobile Telephone Charges 2002 – Low User



Source: OECD 2003.

A low user is a mobile phone user who makes 25 calls per month. Figure 13 shows that New Zealand has higher charges for low users at $254.33 USD PPP compared to Australia with charges of $183.69 USD PPP and ranks 11th highest overall among the 30 countries.

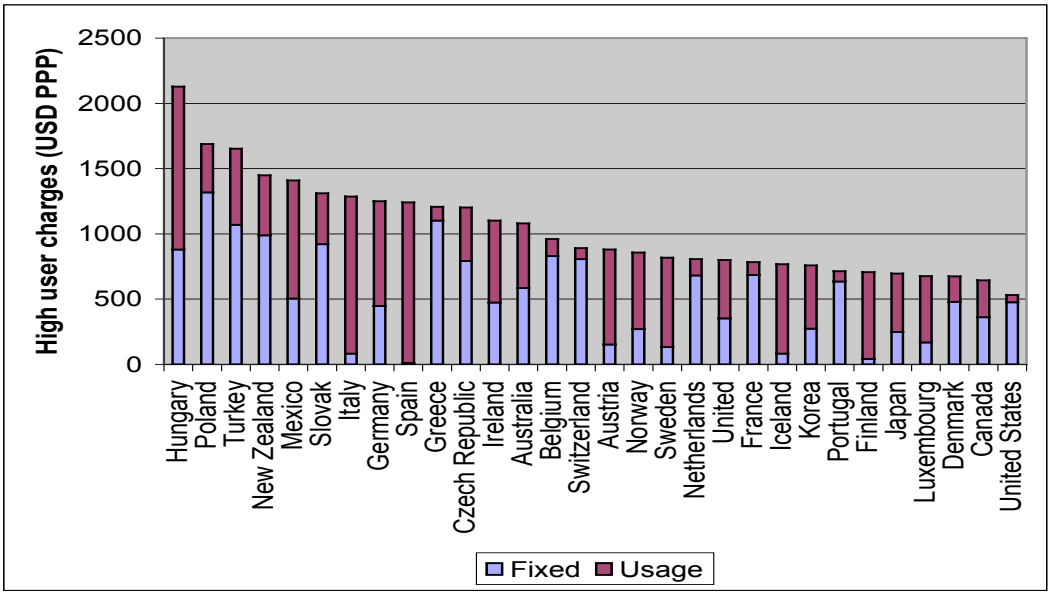
Figure 14. Mobile Telephone Charges 2002 – Medium User



Source: OECD 2003.

A medium user is defined as making 75 calls per month. For medium users, New Zealand is the fourth most expensive country in the OECD price comparison, charging $830.27 USD PPP, while Australia charges $529.81 USD PPP as shown in Figure 14.

Figure 15. Mobile Telephone Charges 2002 – High User



Source: OECD 2003.

A high user makes 150 calls per month. Figure 15 shows that New Zealand is again the fourth most expensive country in the OECD, charging $1,449.29 USD PPP compared to Australia's $1,080.02 USD PPP.

The high cost of mobile telephony in New Zealand relative to other countries is currently the subject of an inquiry by the Commerce Commission[19]. It is noted, however, that high prices do not appear to be a deterrent to purchase and use of mobile connections, as New Zealand is amongst the OECD leaders in the uptake of the technology, and is ahead of countries like Australia and the United States where, by the OECD figures, prices are lower.

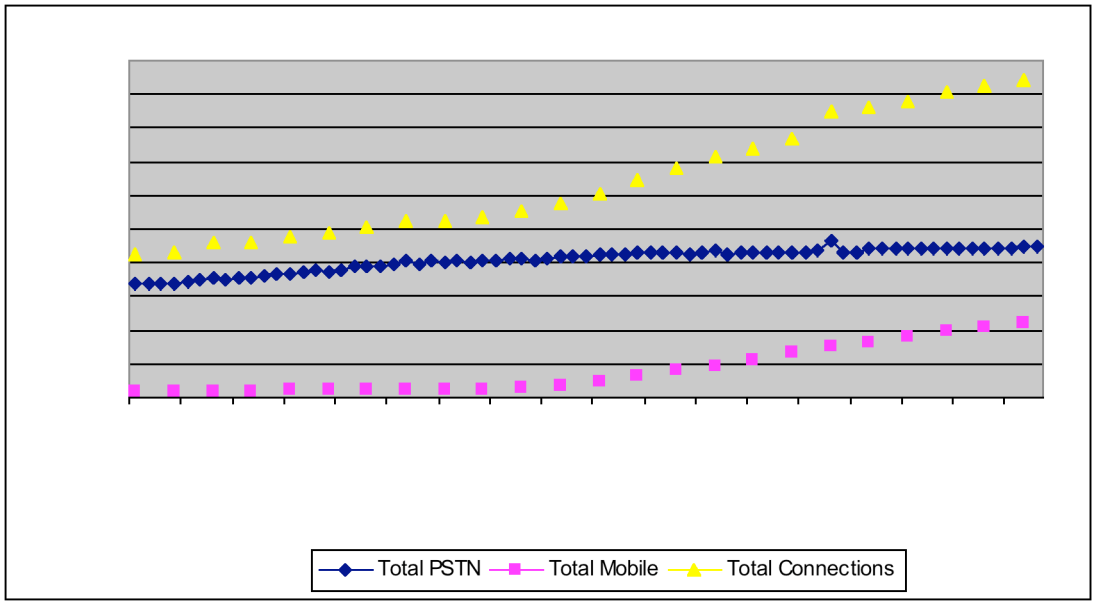
Interaction of Fixed and Mobile Markets

New Zealand is exhibiting signs of market maturity with respect to the number of connections to both fixed and mobile telephony networks. An analysis of the two markets together provides some insights into the interactions between these two markets. Figure 16 shows the total number of telephone connections in New Zealand between 1996 and 2002. The graph

[19] http://www.comcom.govt.nz/IndustryRegulation/Telecommunications/Investigations/Overview.aspx

shows that the levelling off in growth of fixed line connections is co-incidental with the increase in mobile connections, beginning around mid 1998. Figure 2 shows that the decline in residential fixed line connection growth began at this time. The decline in total business fixed line connection growth (both PSTN and ISDN) did not begin until around the beginning of 2000.

Figure 16. New Zealand Fixed and Mobile Connections: 1996-2002



Source: Howell and Obren 2003.

Together, these data tend to suggest that there is some degree of substitution occurring between fixed line and mobile connections. As the cost of second lines is high, but prepaid mobile telephones (first available in 1998) are comparatively cheap, there is anecdotal evidence to suggest that whereas second lines may be preferred by many New Zealand residential consumers as an alternative to second lines for Internet access. That they also offer the additional functionality of voice (and increasingly, text and data) connectivity at any time and any place, means that they are a cost-effective solution to the problem of widening communication needs. Hence, New Zealand is stabilising on a residential telephony diffusion of approximately one fixed line per household (94% of households with a fixed line) and a high level of personal mobile connectivity (over 75% of individuals over 10 years with a mobile phone).

This tends to suggest that both markets are approaching maturity in the number of connections. New 'connections' in the future are likely to be substitutions of new technologies for existing ones (e.g. 3rd generation mobile phones for existing ones) rather than

necessarily connecting any more (proportionately) individuals to the telephony networks, so will not necessarily result in increases in connections per capita.

In summary, therefore, it can be said that the New Zealand telephony market is mature. New Zealanders are widely connected to telephony infrastructures, with high relative prices of mobile telephony apparently not being a deterrent to purchase of these connections. That New Zealand does not have a large number of second lines (as per the United States) means that it is less likely that there will be a large decrease in the number of fixed lines as dial-up Internet users substitute to alternative access methods. That it already has high levels of mobile penetration indicates that substitution between fixed and mobile voice connectivity is well advanced, with the additional benefits of mobile data (e.g. text messaging, mobile payments) being available for these customers as and when they are made available. It would appear that the country is well placed in respect of connectivity to these infrastructures.

Internet Indicators

There is a very wide variety of statistics that offer some insights into the extent of Internet connectivity in New Zealand and worldwide. As new technologies and new uses for the Internet emerge, it becomes increasingly difficult to settle on a range of indicators that give a comprehensive picture. Whilst some lead to convergence on a single technology (e.g. voice and data on mobile telephones), others lead to divergence (e.g. broadband and dial-up as Internet access technologies), making comparisons across time and technologies problematic. Furthermore, comparisons are hampered by the range of that are data available, the methods via which they are collected and the times to which the data relate.

Nonetheless, a core of consistent information indicators has emerged that provides broad indications of the degree of connectivity the citizens of given countries have to the 'Internet economy'. The diffusion of personal computers provides a base measure of 'e-connectedness', whilst numbers of Internet accounts, Internet hosts, web pages, domain names and secure servers provide firstly measures of individual and business connectedness to the Internet, and secondly, indications of the 'connectedness' of specific countries to the use of technologies for commercial purposes. In the tradition of the past two reports, this paper uses the same metrics for comparison.

Personal Computers

Despite the growth of mobile telephony and the options that this technology offers for remote and customised data exchange (e.g. text messaging, video, audio and graphics file exchange), whilst the fixed telephone line remains the main method by which individuals access the Internet, computer penetration of computers per capita is still considered a key connectivity indicator.

Statistics of computer ownership and use vary greatly, depending upon the nature of the survey method used. The time at which the data is collected is also significant when comparing countries. However, some trends are emerging. New Zealand appears to have fewer computers per capita than some other comparator countries such as Australia. However, this may be balanced to some extent by the higher number of mobile telephone connections per capita in New Zealand, when comparing the ability for individuals to access and exchange information via the Internet and Internet-like systems.

ITU statistics[20] show that New Zealand has exhibited a smaller number of computers per capita than Australia since 1990. With 56.45 computers per 100 in 2002 (60.18 in 2003), Australia is amongst the highest computer penetration countries in the world. Only San Marino (75.98), Switzerland (70.87), Singapore (62.20), Sweden (62.13), the United States (65.98), Luxembourg (59.42) and Denmark (57.68) registered a higher penetration in 2002. New Zealand (41.38) was comparable with the United Kingdom (40.57), Hong Kong (42.2), Ireland (42.08), Germany (43.13), Finland (44.17) and Iceland (45.14), slightly behind other comparator countries such as Korea (49.33), Canada (48.70) and the Netherlands (46.66). However, the New Zealand penetration level was higher than that recorded in Japan (38.22), France (34.17) and Italy (23.07). Australia's growth rate in this statistic is also greater than New Zealand's (9.1% vs 7.9% between 2001 and 2002).

Internet Users

However, whilst New Zealand exhibits lower penetration of computers per capita than Australia, there is very little difference in the number of people using the Internet. ITU statistics[21] show that in 2002, New Zealand had 48.44 per 100 using the Internet in 2002, whilst Australia had 53.40. Australia was greater than New Zealand in 1998 and 1999.

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[20] http://millenniumindicators.un.org/unsd/mi/mi_series_results.asp?rowId=607
[21] http://millenniumindicators.un.org/unsd/mi/mi_series_results.asp?rowId=605

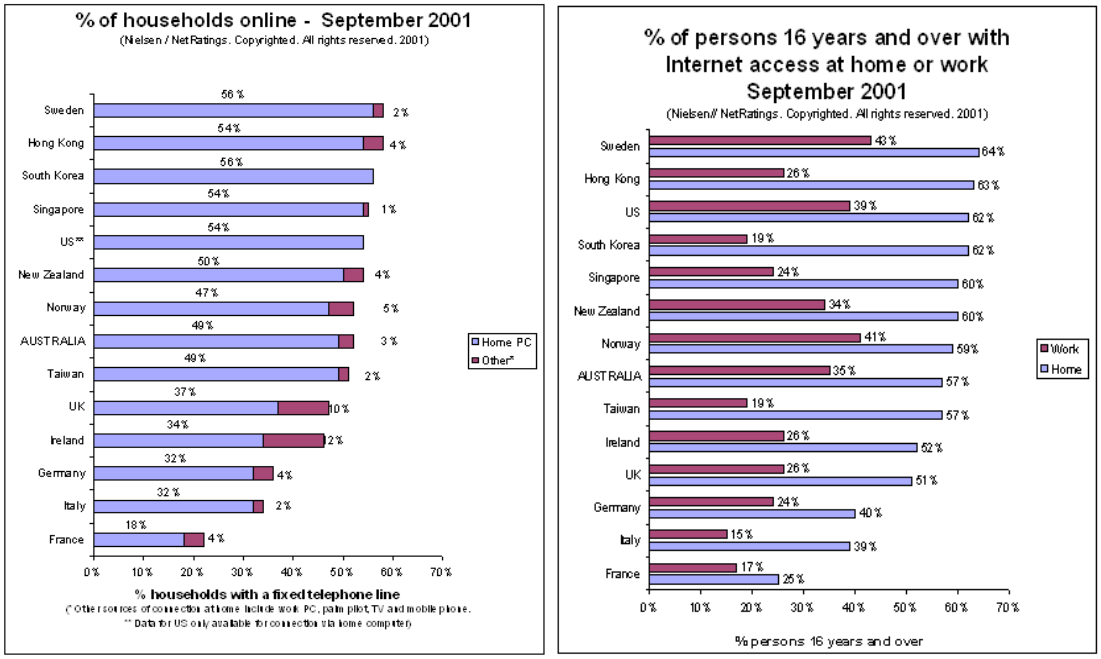
However, both countries were in the top six in the world in this statistic in 2003[22]. Iceland (67.47) remains the world leader, followed by Korea (60.97) and Sweden (57.31). Australia (56.66) is 4th, followed by the United States (55.58), with New Zealand 6th (52.63), ahead of the Netherlands (52.19), Denmark (54.10), Singapore (50.88), and Canada (48.39). Other comparator countries such as Hong Kong (47.18), Japan (48.27), Germany (47.25) and the United Kingdom (42.31) also lag New Zealand by a significant margin. In 2001, New Zealand was 9th in this statistic, and Australia 10th[23].

Thus, despite a smaller number of computers per capita, New Zealand does not appear to be disadvantaged relatively in the number of individuals accessing the Internet. Whilst New Zealand's early lead over Australia in this statistic has been eroded, both countries have improved their performance relative to other countries to be in the top half dozen in 2003.

Survey data from NielsenNet confirms the ITU data. The percentage of Australian households that either own or lease a personal computer (PC) (67%) is slightly higher than the proportion of New Zealand households (62%). Germany, the United Kingdom, Ireland, Italy and France are the only countries (of those included in the survey) with less than 50% of households owning or leasing a PC.[24] As Figure 17 shows, PCs at home remain the dominant Internet access device for the vast majority of households (in New Zealand and in other countries) with 50% of New Zealand households with a fixed telephone line online via home computer and 4% online via other means. The 54% of New Zealand households (with a fixed telephone line) online is close to the Australian figure of 52%. Figures for Internet access at home and at work are also similar for the two countries, with 60% of New Zealanders (aged 16 years and over) reporting Internet access at home and 34% with access at work, compared to 57% of Australians with home access and 36% with access at work. Figure 18 further breaks down the New Zealand access locations in 2003, revealing access at home as the major growth area.

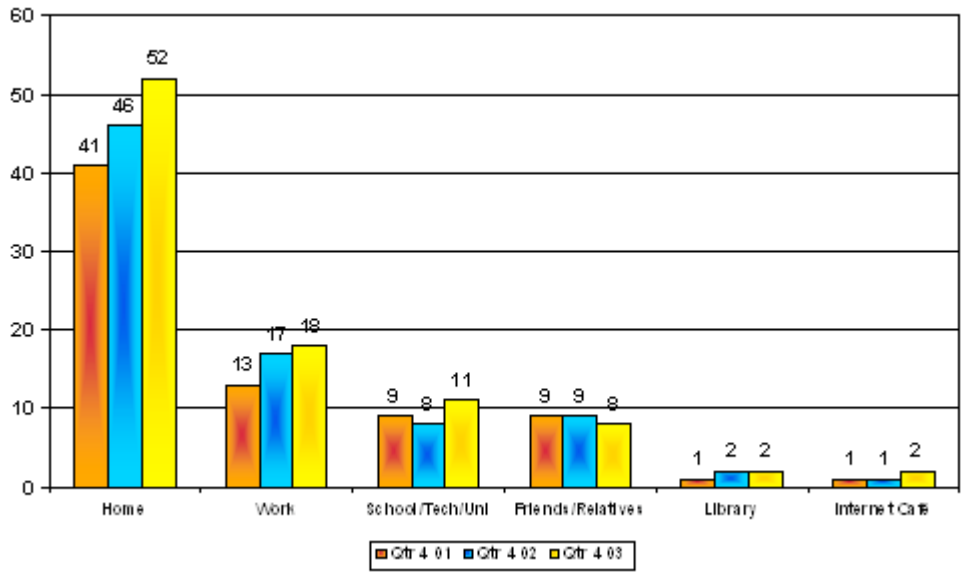
[22] http://www.itu.int/ITU-D/ict/statistics/at_glance/Internet03.pdf
[23] Communications Outlook 2001 p.98.
[24] National Office for the Information Economy 2002.

Figure 17. Internet Access & Households with Personal Computers 2001



Source: National Office for the Information Economy 2002.

Figure 18. Regular Internet Usage by Location – Population 10 Years and Over



Source: http://www.acnielsen.co.nz.

Internet Hosts

Internet hosts reflect the number of computers connected to the Internet by counting domain names that have an associated Internet Protocol (IP) address. Internet hosts thus count the number of computers or other devices connected to the Internet either full or part-time. In

2000 New Zealand was 7th in the number of Internet hosts per capita, and Australia 9th. Figure 19 shows that by 2003, New Zealand has slipped one place to 8th, whilst Australia had risen to 6th. This is probably a factor of the higher number of computers per capita in Australia. However, when comparing Internet hosts as a proportion of Internet users, Australia's rank falls to 7th, whilst New Zealand remains at 8th.

Figure 19 shows that growth in the number of Internet hosts per capita is higher in countries with low numbers of hosts, and lower in those with high numbers, as per a typical technology diffusion pattern. It is notable that New Zealand's growth in this statistic is amongst the lowest (and lower than Australia's), suggesting the diffusion of computers attached to the Internet might be more mature in New Zealand than in other countries. This would be consistent with New Zealand being an earlier adopter. However, it is interesting to note that in absolute terms New Zealand has fewer hosts per capita than other mature markets with similar growth rates (e.g. Finland and the United States).

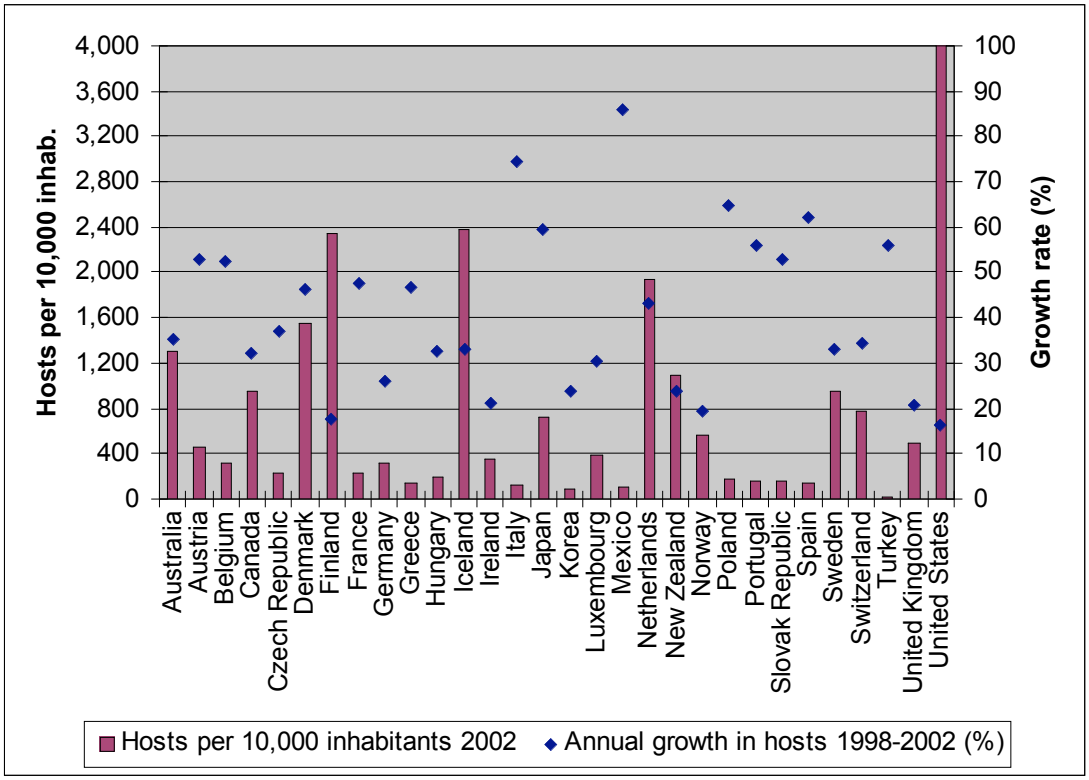
Figure 19. Internet Hosts 2003[25] [This table has been updated – 2003 data]

	Hosts	Hosts per 10,000 inhabitants	Users (000s)	Users per 10,000 inhabitants	Hosts as a % of users	Rank of hosts as a % of users
Australia	2,847,763	1,428.07	11,300.0	5,666.63	25.20	7
Austria	575,903	713.37	3,730.0	4,620.34	15.44	14
Belgium	210,168	202.62	4,000.0	3,856.36	5.25	29
Canada	3,210,081	1,011.99	15,200.0	4,838.61	21.12	9
Czech Republic	276,186	274.41	3,100.0	3,080.10	8.91	24
Denmark	1,248,296	2,312.67	2,920.0	5,409.77	42.75	4
Finland	1,271,634	2,436.55	2,786.0	5,338.19	45.64	3
France	2,403,459	401.24	21,900.0	3,656.08	10.97	21
Germany	2,603,007	315.39	39,000.0	4,725.46	6.67	27
Greece	195,291	170.46	1,718.4	1,499.93	11.36	19
Hungary	369,720	357.76	2,400.0	2,322.39	15.41	15
Iceland	109,521	3,789.65	195.0	6,747.40	56.16	2
Ireland	158,832	399.19	1,260.0	3,166.70	12.61	18
Italy	626,536	114.02	18,500.0	3,366.60	3.39	30
Japan	12,962,065	1,015.68	61,600.0	4,826.87	21.04	10
Korea	3,822,613	797.62	29,220.0	6,096.99	13.08	16
Luxembourg	28,214	624.89	170.0	3,765.23	16.60	13
Mexico	1,333,406	130.57	12,250.3	1,199.57	10.88	22
Netherlands	3,521,932	2,162.66	8,500.0	5,219.46	41.43	5
New Zealand	474,395	1,183.27	2,110.0	5,262.90	22.48	8
Norway	570,710	1,245.93	1,583.3	3,456.53	36.05	6
Poland	786,522	203.82	8,970.0	2,324.50	8.77	25
Portugal	227,002	218.12	2,000.0	1,935.07	11.35	20
Slovak Republic	114,088	212.18	1,375.8	2,558.69	8.29	26
Spain	910,677	222.44	9,789.0	2,391.08	9.30	23
Sweden	943,139	1,050.72	5,125.0	5,730.74	18.40	12
Switzerland	548,044	748.93	2,916.0	3,984.87	18.79	11
Turkey	359,188	50.80	6,000.0	848.51	5.99	28
United Kingdom	3,169,318	545.33	25,000.0	4,230.98	12.68	17
United States	162,208,993	5,577.84	161,632.4	5,558.01	100.36	1

Source: http://www.itu.int/ITU-D/ict/statistics.

[25] Users figures are for 2002 for Canada, , Portugal, Sweden, and the United Kingdom.

Figure 19. Internet Host Growth



Data sources: International Telecommunication Union 2002 (number of hosts) and OECD 2003 (annual growth).

Websites

The number of websites per capita provides an indication of the level of content development in a country. In 2000, New Zealand had 10.5 sites per 1000 inhabitants. This had increased to 15.3 per 1000 inhabitants by 2002. Figure 20 shows the corresponding annual growth of 21% in this period. In the same period, Australian websites increased from 9.2 websites per 1000 inhabitants to 14.5 websites per 1000 inhabitants, translating to annual growth of 26%. While the number of servers across the OECD area increased by 36% per annum between 2000 and 2002, growth rates were slower in countries that were relatively early adopters such as Switzerland, Canada, the United States, Sweden and New Zealand[26]. Neither New Zealand nor Australia changed its overall ranking, maintaining 12th and 13th positions respectively, both well below the OECD average of 31.4 websites per 1000 inhabitants.

[26] OECD 2003, p 126.

Figure 20. Websites

	Websites (July 2000)	Websites (July 2002)	Sites per 1,000 inhab. (2000)	Sites per 1,000 inhab. (2002)	Annual growth (%)	Rank (2000)	Rank (2002)
Australia	176,505	282,139	9.2	14.5	26.4	15	15
Austria	87,485	183,783	10.8	22.6	44.9	13	12
Belgium	60,851	132,987	5.9	13.0	47.8	20	17
Canada	746,796	1,022,949	24.3	32.9	17.0	3	9
Czech Republic	59,926	121,552	5.8	11.8	42.4	21	19
Denmark	111,312	384,341	20.8	71.7	85.8	6	2
Finland	36,869	69,002	7.1	13.3	36.8	17	16
France	252,399	624,250	4.3	10.5	57.3	22	22
Germany	1,802,855	6,970,691	21.9	84.7	96.6	5	1
Greece	12,569	25,209	1.2	2.4	41.6	30	30
Hungary	27,109	62,425	2.7	6.1	51.7	26	25
Iceland	5,068	9,806	18.0	34.4	39.1	8	8
Ireland	12,050	22,260	3.2	5.8	35.9	23	26
Italy	346,903	740,946	6.1	12.9	46.1	19	18
Japan	199,332	371,794	1.6	2.9	36.6	29	29
Korea	309,807	521,388	6.6	11.0	29.7	18	21
Luxembourg	3,264	4,895	7.4	11.1	22.5	16	20
Mexico	16,289	30,526	0.2	0.3	36.9	32	32
Netherlands	269,546	770,259	16.9	48.2	69.0	10	6
New Zealand	40,133	58,879	10.5	15.3	21.1	14	14
Norway	134,773	299,657	30.0	66.4	49.1	2	3
Poland	75,993	176,065	2.0	4.6	52.2	27	27
Portugal	17,137	36,687	1.7	3.6	46.3	28	28
Slovak Republic	14,989	33,676	2.8	6.3	49.9	25	24
Spain	118,841	265,934	3.0	6.6	49.6	24	23
Sweden	170,929	249,132	19.3	28.0	20.7	7	11
Switzerland	120,134	148,218	16.7	20.5	11.1	11	13
Turkey	22,318	62,875	0.3	0.9	67.8	31	31
United Kingdom	1,436,313	3,852,471	24.0	64.2	63.8	4	4
United States	12,569,533	18,167,665	45.6	63.7	20.2	1	5

Source: OECD 2003.

Domain Names

A domain name is the online equivalent of a business or personal name. A count of New Zealand's domain names provides a measure of business and/or individual presence on the web. Whilst domain name registrations have been used historically as an indication of the number of web-based identities, this measure is less perfect as more names are registered to reserve rights for future use or to prevent others from appropriating the name. Furthermore, whereas previously it was typically businesses that registered domain names, and thus the register could be used as a measure of business use of the Internet, increasingly individuals are registering domain names as well. It is thus becoming a less useful measure. However, in keeping with past reports, it is identified here.

As illustrated in Figure 21, New Zealand had a 28% increase in domain name registrations (.nz) between 2000 and 2002. Over the same period, Australia's registrations increased by 29.7%. The only country to record a decline in domain name registrations was Korea. Australia and New Zealand were ranked 18th and 19th overall respectively.

Figure 21. Domain Name Registrations[27]

	Domain	Registrations (July 2000)	Registrations (July 2002)	Annual Growth
Australia	.au	148,539	250,000	29.7
Austria	.at	157,387	252,441	26.6
Belgium	.be	32,709	20,989	151.6
Canada	.ca	60,000	300,000	123.6
Czech Republic	.cz	66,555	119,145	33.8
Denmark	.dk	208,300	397,552	38.2
Finland	.fi	17,603	36,210	43.4
France	.fr	89,097	155,554	32.1
Germany	.de	1,732,994	5,666,269	80.8
Greece	.gr	18,670	55,000	71.6
Hungary	.hu	...	81,804	...
Iceland	.is	3,300	8,200	57.6
Ireland	.ie	15,506	29,920	38.9
Italy	.it	417,609	735,156	32.7
Japan	.jp	190,709	482,644	59.1
Korea	.kr	494,074	479,643	-1.5
Luxembourg	.lu	11,404	15,454	16.4
Mexico	.mx	49,947	71,590	19.7
Netherlands	.nl	532,596	748,510	18.5
New Zealand	.nz	67,777	111,000	28.0
Norway	.no	45,541	150,000	81.5
Poland	.pl	56,708	...	...
Portugal	.pt	14,394	26,158	34.8
Slovak Republic	.sk	...	57,091	...
Spain	.es	29,590	40,952	17.6
Sweden	.se	45,241	102,785	50.7
Switzerland	.ch	112,912	422,907	93.5
Turkey	.tr	...	40,059	...
United Kingdom	.uk	1,938,740	3,635,585	36.9

Source: OECD 2003.

[27] This table excludes figures from the United States, which include generic domain names.

Secure Servers

Measures of secure servers provide one of the best available indicators of the existing infrastructure supporting secure e-commerce. Secure socket layer (SSL) protocol servers provide a secure encrypted transmission over TCP/IP networks, facilitating safe and secure e-commerce over the Internet.

Figure 22. Secure Servers in OECD Countries

	Secure servers (July 1998)	Secure servers (July 2000)	Secure servers (July 2002)	Per 100,000 Inhabitants (July 1998)	Per 100,000 Inhabitants (July 2000)	Per 100,000 Inhabitants (July 2002)	Annual growth (%) 1998-2002
Australia	632	2,828	4,693	3.4	14.7	24.1	65.1
Austria	98	447	949	1.2	5.5	11.7	76.4
Belgium	52	268	439	0.5	2.6	4.3	70.5
Canada	929	3,896	7,768	3.1	12.7	25.0	70.0
Czech Republic	19	194	185	0.2	1.9	1.8	76.6
Denmark	44	289	660	0.8	5.4	12.3	96.8
Finland	68	343	744	1.3	6.6	14.3	81.9
France	222	1,297	2,511	0.4	2.2	4.2	83.4
Germany	492	3,761	7,987	0.6	4.6	9.7	100.7
Greece	8	87	170	0.1	0.8	1.6	114.7
Hungary	18	90	86	0.2	0.9	0.8	47.8
Iceland	13	67	136	4.7	23.8	47.7	79.8
Ireland	56	245	579	1.5	6.5	15.1	79.3
Italy	167	795	1,167	0.3	1.4	2.0	62.6
Japan	429	2,900	7,179	0.3	2.3	5.6	102.3
Korea	38	243	562	0.1	0.5	1.2	96.1
Luxembourg	11	44	97	2.6	10.0	22.0	72.3
Mexico	26	176	324	0.0	0.2	0.3	87.9
Netherlands	127	541	1,332	0.8	3.4	8.3	80.0
New Zealand	90	482	983	2.4	12.6	25.5	81.8
Norway	55	273	528	1.2	6.1	11.7	76.0
Poland	23	188	373	0.1	0.5	1.0	100.7
Portugal	27	116	214	0.3	1.2	2.1	67.8
Slovak Republic	15	45	38	0.3	0.8	0.7	26.2
Spain	239	759	1,315	0.6	1.9	3.3	53.2
Sweden	145	811	1,246	1.6	9.1	14.0	71.2
Switzerland	152	854	1,555	2.1	11.9	21.5	78.8
Turkey	7	116	400	0.0	0.2	0.6	174.9
United Kingdom	714	4,404	10,288	1.2	7.4	17.1	94.8
United States	14,674	65,565	106,884	5.4	23.8	37.5	64.3

Source: OECD 2003.

In 2002, Iceland had the highest number of secure servers per capita at 47.7 per 100,000 inhabitants, followed by the United States with 37.5. Consistent with its past performances, New Zealand at 25.5 ranked third overall and Australia ranked fifth with 24.1 secure servers

per 100,000 inhabitants. This statistic implies that a significant number of e-commerce transactions per capita requiring secure transmission are being conducted in New Zealand relative to other countries.

Whilst a less robust measure of e-commerce activity, links pointing from each domain to secure servers provides some measure of the use and interest in secure servers, and hence the level of use of secure servers for e-commerce. This is achieved by using a search engine, such as Google, to count the number of links under a country code (e.g. .nz) or a generic name (e.g. .com) that contain references to secure socket layer servers in the URL. In 2002, references from the .nz domain were 9th in the OECD (after USA (.us, .gov, .edu, .mil), .net, .org, .de, .jp, .uk, .au and.ch)[28]. This is consistent with the high number of secure servers in New Zealand, high Internet use, and the perception of relatively high levels of e-commerce use and sophistication in New Zealand. Interestingly, Iceland, with the highest number of secure servers per capita, was 7th to last in this measure.

Broadband Access

Since the last *State of E-New Zealand* report, the main change in Internet user behaviour has been the uptake of broadband, which is growing rapidly in OECD countries. Replacement of dial-up accounts by broadband accounts is the only area for potential current and future significant change in the telephony market in New Zealand.[29] There are many definitions of broadband based on speed and 'always on' capability. Broadband is defined by ITU as "a transmission capacity that is faster than primary rate ISDN, at 1.5 or 2.0 Mbit/s".[30] This paper uses the functional definition of 'always on' capability.

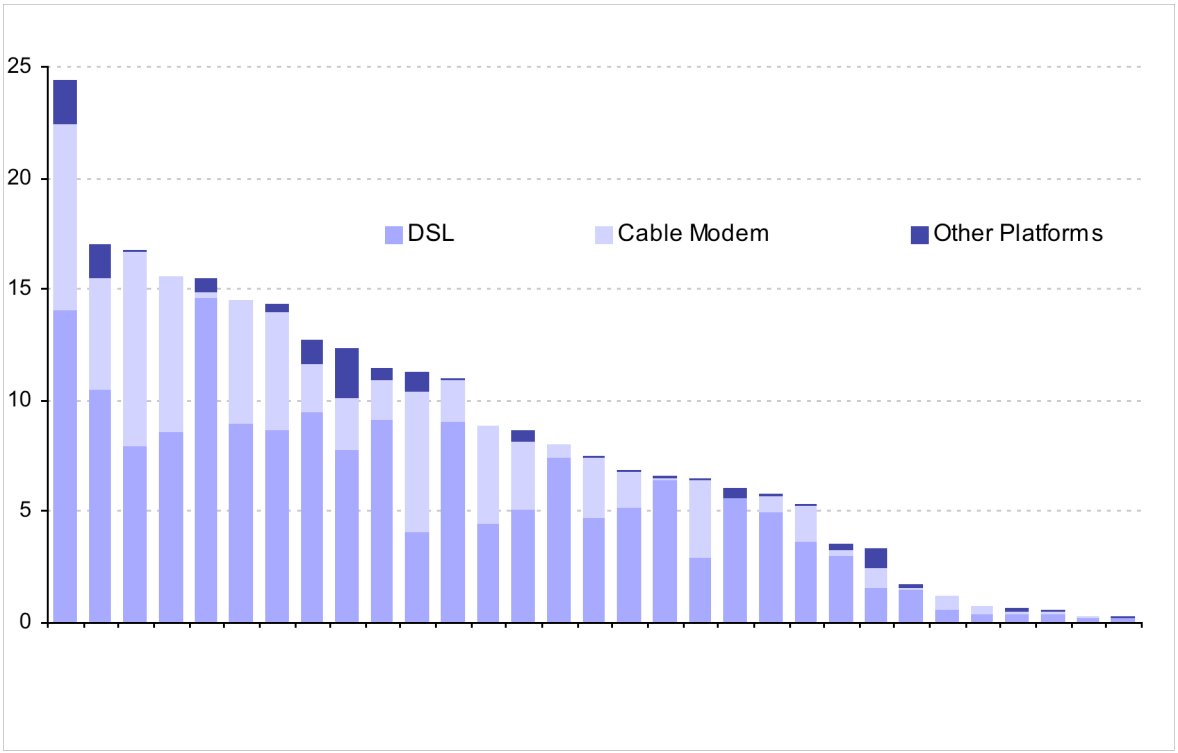
There are two types of broadband infrastructure – wired and wireless. Wired infrastructure consists of copper, fibre and cable. DSL is the most common type of broadband technology. It utilises the existing copper infrastructure by splitting voice and data services at different frequencies. "With wireless broadband still in relative infancy, most broadband users rely on fixed line connections to access the Internet"[31]. Broadband access supports a more sophisticated and intensive use of online content, particularly in relation to accessing high bandwidth interactive services such as e-learning, interactive games, video on demand and improved telephony. In a sample month of Xtra's residential, unmetered broadband product,

[28] OECD, 2003: 129.
[29] Howell & Obren 2003, p 39.
[30] International Telecommunication Union 2003, p 9.
[31] International Telecommunication Union 2003, p 32.

over 50% of available bandwidth was consumed by less than 10% of the customers, indicating a small number of very intensive users, with the majority presumably gaining benefit from time savings and application feasibility.[32]

New Zealanders in Wellington and Auckland have had access to broadband since 1996. Currently, six competing platforms (Ethernet LAN, Satellite, DSL, Cable, Wireless and Mobile) are available. New Zealand has wide geographic coverage of mobile and satellite services with 85% of telecommunications customers having access to DSL services in 2003, projected to be 92% in 2005. In 2003, ten central business districts had access to wireless with a further nine planned.[33]

Figure 23. OECD Broadband Subscribers per 100 Inhabitants June 2004.



Source: OECD http://www.oecd.org/dataoecd/19/42/34082810.xls

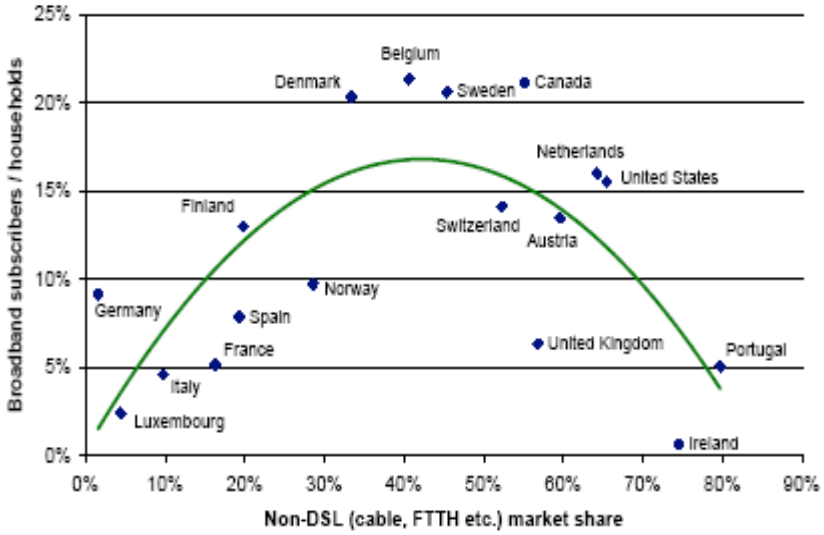
Despite the very high numbers of New Zealanders accessing the Internet, the vast majority of Internet users still use low-speed dial-up connections in the home. Given the country's wide availability of broadband infrastructure, New Zealand has exhibited very low uptake of high-

[32] Howell & Obren 2003, p 41.
[33] Howell 2003b, pp 3 and 24. The availability of wireless in certain areas has been held up since Howell's paper was written, with Woosh (one of the wireless providers) not meeting original targets. See the joint MED and Ministry of Education's Project Probe website http://www.probe.govt.nz for further details.

speed Internet connections. Figure 23 shows that in June 2004, New Zealand, with 3.6 connections per 100, ranked 24th in the OECD, behind Australia (23rd – 5.3). The leader is Korea (24.4). New Zealand is progressively slipping in this statistic. In June 2002, it was 21st (Australia was 18th). Whilst both countries have seen siginficant growth in the number of brooadband connections, both are continuing to fall down the OECD league tables in this metric.

The comparatively low levels of broadband uptake in both Australia and New Zealand are something of an anomaly, given that both countries these countries exhibit very high comparative connectivity in all other Internet statistics, have wide availability of broadband services, and have all of the underpinning telecommunications infrastructures that are considered essential to the operation of an information economy. Many possible explanations have been offered, including the absence of local loop unbundling in New Zealand (although this is not a factor in Australia, pricing policy (although at levels of consumption evidenced, these are internationally competitive) including the policy of charging per megabyte for data transferred, and very low charges for dial-up Internet access (discussed subsequently).

Figure 24. Broadband penetration and platform competition



Source: Maldoom and Sidak 2003.

One explanation that has some plausibility in the Australian and New Zealand context is the comparative absence of strong inter-platform competition in these countries. Figure 24 shows that, from European data, broadband penetration is highest when the market shares of DSL and other broadband connections are approximately equal. If one infrastructure dominates, then total broadband penetration appears to be less. Given that the share of cable in the

Australian broadband market has been small (due principally to common ownership of telecommunications and cable companies until recently resulting in prioritisation of the telecommunications product over the cable one), and that alternative platforms in New Zealand have tended to be, until recently, regional niche players, this explanation warrants further investigation.

New Zealand's low broadband penetration overall, however, masks an underlying trend where business uptake is significantly greater than residential uptake. Howell (2003: 44-51) shows that business connections have dominated New Zealand DSL purchases, and when compared on a connection per business basis, accounting for business size, penetration of the technology in the business market is significantly greater than that exhibited in Australia, the United Kingdom and Norway. In particular, in the category for businesses with 10 or more employees, the New Zealand penetration rate is 2.5 times that in Norway, despite Norway having an overall broadband penetration rate three times that of New Zealand's. Thus, it appears that New Zealand's poor broadband penetration rate is a consequence of factors in the residential market alone. This lends further credence to the proposal that unmetered residential local telephony pricing, and the flow-through effect upon prices for Internet access, are significant factors in accounting for New Zealand's performance in this statistic.

Internet Access Prices

Globally, pricing strategies have shifted significantly towards unmetered pricing as competition for the broadband market increases. The *OECD Communications Outlook 2003* indicates that there has been far greater demand for unmetered dial-up Internet access than telephony (in other words, Internet usage demand rather than voice consumption has driven growth in availability of unmetered telephony and ISP packages), with over twice the number of countries offering unmetered access in 2002 as there were in 2000.[34] However, there is growing recognition that offering unmetered broadband packages may not be conducive to encouraging switching of low-volume users from dial-up to broadband. In the United States, for example, metered packages, especially of low speed, low volume form, are now being offered.

Dial-up Prices

The previous State of e-New Zealand studies have noted the internationally comparatively low prices for dial-up access to the Internet. As New Zealand local telephony customers do

[34] OECD 2003, p 152.

not pay a connection or per-minute charge for telephony connections to Internet Service Providers (ISPs), the only out-of-pocket charges faced by consumers are those charged by the ISP. New Zealand ISP charges have also been internationally low, with New Zealand being one of the first countries to offer unlimited access for one price (unmetered access) (Boles de Boer, e*t al*., 2000). Approximately 80% of dial-up customers use unmetered access (Howell, 2003:20).

Recent OECD and New Zealand benchmarking shows that this is still the case. New Zealand compares favourably with OECD average prices in both the 20-hour and 40-hour baskets. New Zealand's daytime PSTN rate for 20 hours of Internet use is $33.10 USD PPP (OECD average is $44.01 USD PPP) and evening is $38.54 USD PPP (OECD average is $34.97 USD PPP). The PSTN rate for 40 hours of Internet use in the daytime is $35.82 USD PPP (OECD average is $64.20 USD PPP) and in evenings is $41.26 USD PPP (OECD average is $47.08 USD PPP).[35] Howell's survey shows that New Zealand dial-up packages are the 1st, 2nd, 3rd and 8th cheapest out of 70 European and United States products. However, the OECD benchmarking reveals that using their basket for 40 hours off peak services, Australian prices are marginally lower.

The quality of New Zealand dial up Internet access is also high, with an average speed of 46.3kbps, compared to IBM (45.7), TDSNet (35.2) and WebUSA (32.8) (Howell, 2003: 20). Therefore, the marginal cost of accessing high quality dial-up Internet is thus zero for most New Zealand dial-up Internet customers.

Broadband Prices

Much has been said about the prices for broadband access being a deterrent to use of the product in both the New Zealand and Australian markets. Until recently, both Australian and New Zealand ISPs have tended to charge broadband consumers per megabyte downloaded (Howell, 2003a). This is in part due to the fact that over 85% of the data transferred to New Zealand Internet users comes from offshore, and must be channelled through the monopoly Southern Cross cable. Until 2004, at which time an additional cable linking Australia and Asia was lit, Australia was also serviced solely by the same cable. The prices that New Zealand ISPs face, and must pass on to their customers, are determined in part by the purchase of international bandwidth from Southern Cross, and hence reflect Southern Cross prices and pricing strategies. It is noted that Iceland, similarly serviced by a solitary cable, is

[35] OECD 2003, pp 174-175.

the only other OECD country where DSL customers are routinely charged per megabyte of data transferred (Howell, 2003).

Using per megabyte pricing methodologies, both Australian and New Zealand prices appear very expensive in comparison to unmetered products, especially where the price benchmarking process compares baskets with very large monthly data consumption quantities (for example, Oftel uses baskets with 10Gb, 16Gb and 20Gb of data transfer per month). Furthermore, the comparisons are quite misleading when the price and volume comparisons are made on services of vastly different speed. For example, until 2004, the basic ADSL speed offered to New Zealand consumers was 2Mbps. When packages based on this speed are compared to the very much slower 245kbps products that are commonplace in Europe and North America, the New Zealand packages compare poorly. However, such comparisons are quite misleading, as they relate to a product in a very different quality category (nearly 8 times the speed).

When allowing for the speed of services offered, the New Zealand products are more competitive. Using the Oftel baskets for high speed (in excess of 1500kbps), Howell (2003:35) shows that the New Zealand 2Mbps business DSL products were lower priced than the Oftel average for all data quantities downloaded up to 10Gb/month. Likewise, the New Zealand residential products were less than the Oftel average for slower speed (128kbps) and lower data quantities downloaded. Moreover, in extended benchmarking against Australian service providers, Howell (2003a) shows that the New Zealand ADSL products are between 4% and 15% less expensive than Australian products of comparable quality.

As the average quantity of data downloaded by New Zealand users was, in 2003, within the lower ranges used in the Oftel benchmarking (Howell and Obren, 2003), it does not appear that New Zealand users were paying more than their counterparts in Europe and the United States, given the quality and quantity of services consumed. Indeed, New Zealand users appear to have been paying less in most cases for equivalent services relative to other low volume users, simply because they did not have to pay for data transfer capacity that they did not use, as occurs when due to extensive use of unmetered packages in the comparator countries. As recent changes arising from the availability of bitstream services from Telecom have seen the introduction by most New Zealand ISPs of lower speed, high volume products for prices very similar in nominal terms to those considered in the restricted downloading benchmarking, it is likely that New Zealand's relative position in broadband prices has recently improved.

Ratio of Dial-Up to Broadband Prices

Whilst New Zealand's broadband connectivity is low, it has been suggested that this may be occurring due to a combination of the low prices and very high quality of dial-up Internet services (Howell, 2003) and a shortage of applications requiring the transfer capabilities of broadband that deliver benefits of sufficient value to the consumer to induce switching from dial-up to broadband (Howell and Obren, 2002). Figure 25 shows a comparison of ratios of dial-up to broadband prices across ten countries.

Figure 25 reveals that, aside from Mexico, New Zealand had the lowest measurement by this ratio in 2002 of the ten OECD countries examined. This gives some credence to the proposition that the additional benefits a consumer must receive from switching from dial-up to broadband must be greater in New Zealand to achieve the same levels of broadband uptake as exhibited in countries where the ratio is lower. As Australia has a similar low ratio (although it is 42% higher than the New Zealand ratio), such an explanation may account for the low broadband penetration in both of these countries, despite the strength of all other 'Internet economy' indicators exhibited.

Figure 25. Dial-up and DSL Prices 2002[36]

Unmetered Usage (to Sept 2002)

	Dial-up (USD PPP)	DSL (USD PPP)	Bandwidth (kbit/s)	Dial up/DSL Price Ratio	DSL Penetration (to June 2002)
Mexico	20.39	129.51	512	0.16	0.08
Korea	22.31	40.9	1500	0.55	12.09
Canada	15.73	27.56	960	0.57	4.27
Australia	23.82	54.3	512	0.44	0.56
New Zealand	19.00	60.5	2000	0.31	0.99
Portugal	78.97	96.48	768	0.82	0.05
Spain	65.64	123.04	512	0.53	1.65
United Kingdom	23.57	39.8	500	0.59	0.52
United States	23.31	39.95	768	0.58	1.77
Finland	25.89	55.73	512	0.46	2.31

Source: Data adapted from OECD 2003.

Summary

New Zealand continues to hold its high ranking amongst the OECD countries in respect of connectivity indicators. Availability of and connection to telephony, computers and Internet infrastructures continues to be high, meaning the potential for utilisation of the infrastructures

[36] Dial-up based on 40 hours at daytime discounted PSTN charges.

that underlie the accrual of benefits from an 'e-economy' is present. Indeed, New Zealand is in the top third in respect of most of these indicators, especially the number of people connected to mobile telephony and the Internet, Internet hosts, secure servers, and business broadband connections. Internet prices (including broadband) are amongst the lowest in the OECD, considering the speed and quality of service. Whilst telephony prices do not compare as well (and indeed are higher than the OECD average for mobile), it must be considered that New Zealanders enjoy very wide coverage of high quality services, despite the difficult terrain, small population, low population density and challenging geography over which the services must be provided.

That these levels of connectivity can be achieved despite the disadvantages of scale and distance that New Zealand faces is commendable.

Capability

Capability is a measure of the country's human, organisational and environmental potential to exploit the infrastructure available. The availability of qualified people to innovate and generate new products and services is essential for continuous growth of the technology sector. However, the ability to also utilise existing technologies, applications and infrastructures is also important, as is the political, regulatory and institutional environment in which this happens. This section explores some of these factors. Due to a lack of consistent international data, in most instances it is difficult to compare the New Zealand statistics with those from other countries. Hence, this section largely examines the nature of changes in the New Zealand context.

Hardware Markets

A country's trade surplus or deficit in communication equipment per capita indicates its relative comparative advantage in the sector. From 1991 to 2001, New Zealand's growth in communication equipment exports was approximately 11%, while in the same period overall OECD growth was 13%.[37] Total export sales of information technology (IT) commodities (excluding communication services) increased by 22% [decreased by 30%] between the 2001 [2002] and 2002 [2003] financial year.[38] In the period 1991 to 2001, communication equipment imports growth in New Zealand was approximately 6% compared to overall OECD growth of 12%.[39]

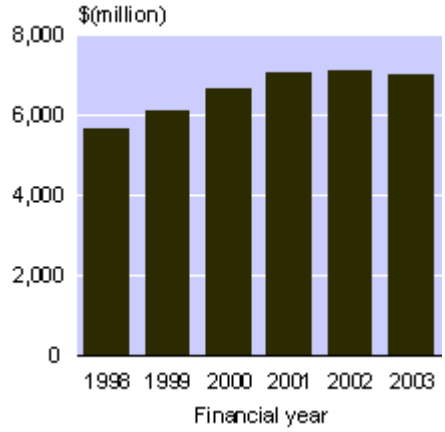
Although New Zealand had a trade deficit per capita of $111 USD on communication equipment in 2001, the increase in exports in 2002 indicates that the country is starting to capitalise on the expanding ICT market offshore (although it is relatively minor when compared to countries like the United States). Communication equipment in New Zealand accounts for less than 1% of total merchandise exports.[40]

Sales of IT goods and services within New Zealand (excluding communication services) has stabilised following a period of growth from 1998 to 2000, as shown in Figure 26. The

[37] OECD 2003, p 240.
[38] Statistics New Zealand 2002 [2003].
[39] OECD 2003, p 241.
[40] OECD 2003, pp 229 and 233.

recorded increase was 1% [decrease was 1%] from the 2001 [2002] financial year to the 2002 [2003] financial year.[41]

Figure 26. Total IT Sales (excluding communication services) in New Zealand



Source: Statistics New Zealand 2003

Human Capability

According to the OECD, "highly skilled human resources are essential for the development and diffusion of knowledge and constitute the crucial link between technological progress and economic growth, social development and environmental well-being."[42] Statistics New Zealand has applied a framework developed by the OECD to its 1996 and 2001 Census data which measures human resources in science and technology (HRST) using qualification and occupation data and indicates how many people are potentially available to work in science and technology areas (Figure 27). Though data does not specify ICT workers, it can be assumed that these workers would have the basic technology skills required to use ICTs.

At the last census in 2001, HRST made up 24.3% of the labour force in New Zealand. This proportion closely matches that of France and the United Kingdom.[43] Figure 28 examines occupations by industry in 1996 and 2001. As such, it gives an indication of how HRST are allocated across different areas of the economy. The industries with the largest number of human resources in science and technology occupations (HRSTO) in 2001 were property and business services (employing 17.6% of the total stock of HRSTO), education (16.9%) and health and community services (13.1%). This pattern reflects the changing nature of the New

[41] Statistics New Zealand 2002 [2003].
[42] OECD 1995, p 3 (cited in Statistics New Zealand 2003a, p 205).
[43] Statistics New Zealand 2003a, p 206.

Zealand commerce environment from a focus on primary industry to a more service-focussed economy. It also reflects the industries where creation and transmission of large volumes of information are fundamental to the industry value chain.

Figure 27. Technology Occupations by Industry in New Zealand, 2001

Industry Group	HRSTO					
		Professionals				
	Specialist Managers[1]	Professionals - Group 1[2]	Professionals - Group 2[3]	Technicians and Associate Professionals - Group 1[4]	Technicians and Associate Professionals - Group 2[5]	Total
2001						
Agriculture, Forestry and Fishing	5,076	1,797	969	1,293	1,086	10,21
Mining	366	210	57	111	39	78
Manufacturing	18,627	8,490	6,129	5,880	8,409	47,53
Electricity, Gas and Water Supply	621	774	363	438	486	2,67
Construction	5,094	3,876	903	2,553	1,650	14,07
Wholesale Trade	17,997	4,449	2,565	2,016	12,318	39,34
Retail Trade	32,244	3,672	1,860	2,460	6,114	46,34
Accommodation, Cafes and Restaurants	17,397	306	1,116	261	1,161	20,23
Transport and Storage	5,271	1,773	1,068	3,339	6,510	17,96
Communication Services	2,283	1,602	897	1,236	1,842	7,86
Finance and Insurance	8,088	2,391	6,306	735	8,676	26,19
Property and Business Services	19,872	23,319	30,231	8,145	22,350	103,91
Government Administration and Defence	3,903	4,761	12,054	3,444	5,352	29,50
Education	7,698	2,364	75,750	11,511	2,283	99,60
Health and Community Services	5,457	39,801	15,339	15,366	1,404	77,36
Cultural and Recreational Services	4,593	921	7,014	2,160	6,762	21,45
Personal and Other Services	3,618	1,242	6,804	1,848	2,880	16,39
Not Elsewhere Included	2,169	1,284	3,537	771	1,512	9,27
Total	160,371	103,032	172,959	63,573	90,834	590,76

(1) Production and Operations Department Managers; Other Department Mangers; General Managers.
(2) Physical, Mathematical and Engineering Science Professionals; Life Science and Health Professionals.
(3) Teaching Professionals; Other Professionals.
(4) Physical and Engineering Science Associate Professionals; Life Science and Health Science Associate Professional
(5) Teaching Associate Professionals; Other Associate Professionals.

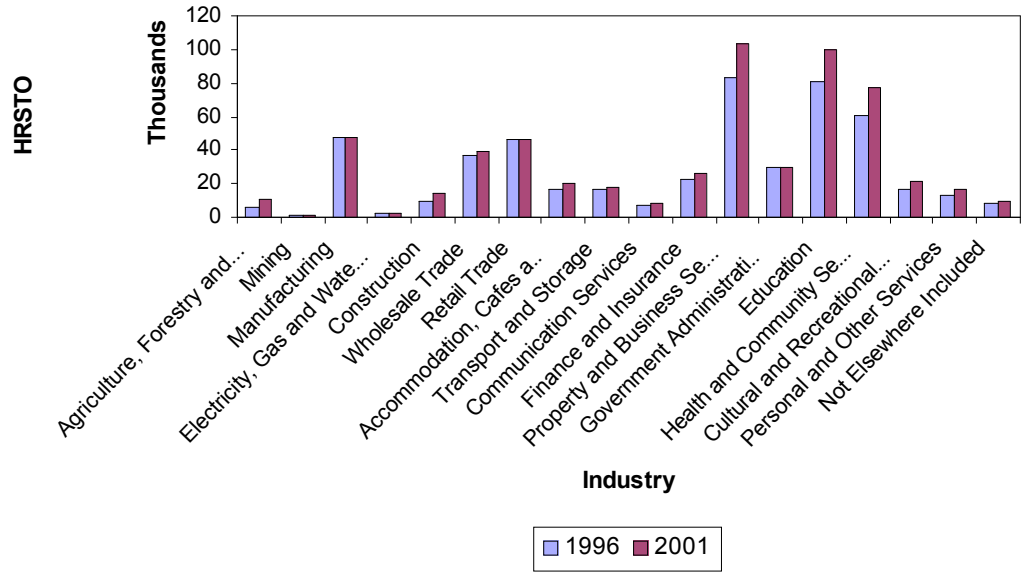
Source: Statistics New Zealand 2003a.

Interestingly, Statistics New Zealand's *Information Technology Use in New Zealand: 2001* showed that the number of computers programmers had declined by 7% between 1996 and 2001[44], while the number of IT managers had increased by 49% and IT technician numbers had remained relatively stable. This is illustrated in Figure 29. This is probably a reflection of the decentralisation of the industry away from customised applications developed by specialists within computer companies towards widespread application of generic packages

[44] Statistics New Zealand 2002, p 32.

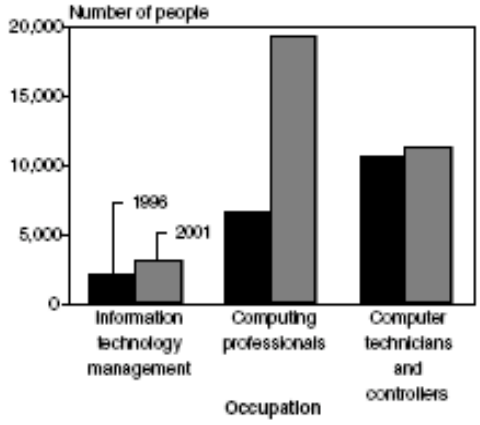
(e.g. software) with customised local development. This is an indicator of the widespread acceptance of information technology applications as 'mainstream' business tools in the New Zealand environment.

Figure 28. New Zealand HRSTO Industry Totals



Data source: Statistics New Zealand 2003a.

Figure 29. Information Technology Occupations in New Zealand



Source: Statistics New Zealand 2002.

Individual Skills

Education and training are recognised as important components in creating a workforce with skills to implement and utilise new technologies. Tertiary institutions provide specific training in information communication technologies. Figure 30 outlines the number of

students enrolled in formal qualifications at tertiary education providers and their areas of study at 31 July 2001. Figure 31 shows the change in registrations between 1997 and 2002.

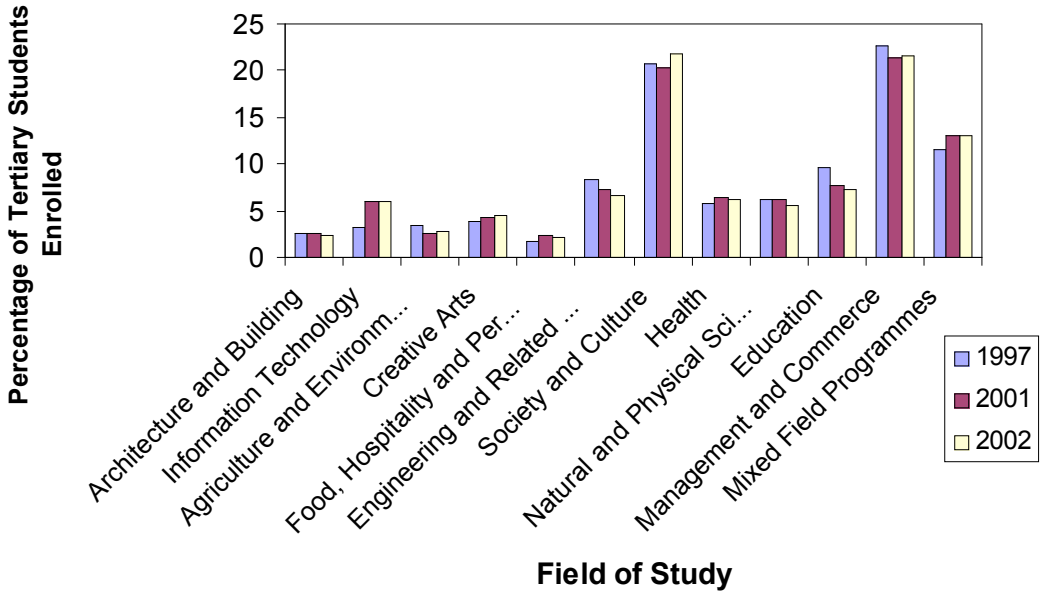
Figure 30. Tertiary Enrolments 31 July 2001

Field and Subfield of Study		Post-Graduate Level	Degree Level	Diploma Level	Certificate Level	Total
		Total	Total	Total	Total	Total
1. Natural and Physical Sciences	Mathematical Sciences	62	-	16	59	137
	Earth Sciences	8	-	-	-	8
	Biological Sciences	-	78	54	71	203
	Other Natural and Physical Sciences	2,946	13,584	324	1,252	18,106
	Sub Total	**3,016**	**13,662**	**394**	**1,382**	**18,454**
2. Information Technology	Computer Science	244	2,863	1,246	3,056	7,409
	Information Systems	33	783	3,350	3,650	7,816
	Other Information Technology	190	12	37	4,135	4,374
	Sub Total	**467**	**3,658**	**4,633**	**10,841**	**19,599**
3. Engineering and Related Technologies	Manufacturing, Engineering and Technology	-	229	230	653	1,112
	Process and Resources Engineering	11	-	19	492	522
	Automotive Engineering and Technology	-	-	71	1,281	1,352
	Mechanical/Industrial Engineering & Technology	16	-	1,032	4,764	5,812
	Civil Engineering	-	-	603	30	633
	Geomatic Engineering	20	148	64	-	232
	Electrical/Electronic Engineering & Technology	15	277	1,463	2,370	4,125
	Aerospace Engineering and Technology	17	437	90	346	890
	Maritime Engineering and Technology	-	-	50	666	716
	Other Engineering and Related Technologies	458	5,115	181	1,023	6,777
	Sub Total	**537**	**6,206**	**3,803**	**11,625**	**22,171**
10. Creative Arts	Performing Arts	140	1,152	739	697	2,728
	Visual Arts and Crafts	120	1,025	968	565	2,678
	Graphic and Design Studies	108	2,044	842	797	3,791
	Communication and Media Studies	129	919	298	601	1,947
	Other Creative Arts	41	474	666	267	1,448
	Sub Total	**538**	**5,614**	**3,513**	**2,927**	**12,592**

Total Enrolments	**24,902**	**119,419**	**46,269**	**110,651**	**301,241**

Source: Minstry of Education

Figure 31. Fields of Study, 1997-2002



Adapted from Ministry of Education 2001 and 2002.

Figure 31 highlights the sharp growth in the number of IT enrolments between 1997 and 2002, indicating increasing levels of specialist technology skills within the country's human capital base. However, the static and falling levels of enrolments in the areas where high volumes of information are created and transferred (i.e. the information processing professions) of health, education, management and commerce may raise some concerns.

Political, Legal, Institutional Environment

Whilst it is recognised that the nature of the political, legal and institutional environment affects the capability of a country to take advantage of connectivity levels, and as such is instrumental in leading to uptake and hence performance, these elements are very difficult to measure, let alone compare. Nonetheless, a number of studies, based around a theme of 'e-readiness' have been undertaken. Whilst imperfect, some are discussed below.

The other single measure which has been used to measure a nation's ability to utilise underpinning infrastructures is the extent of regulation in telecommunications markets. The presumption has been that with the 'appropriate' set of regulatory instruments, existing and new technologies will be deployed at an 'appropriate' time, and will be made available to

users at prices that induce 'appropriate' levels of connectivity and utilisation. Whilst undeniably the nature of the regulatory environment in a country will affect all of these factors, the authors have elected not to explore different telecommunications regulatory regimes in this paper. However, as connection to telecommunications infrastructures form only one part of the measures of performance for 'e-New Zealand', and because the preceding statistics do not indicate that New Zealand is especially disadvantaged in respect of the majority of metrics explored here, including telecommunications ones, it is unlikely that a detailed discussion of subtle differences in telecommunications regulatory regimes, and in particular the role of one instrument, Local Loop Unbundling (LLU), will add significant additional insights into the state of e-New Zealand. It is noted that in 2003, the New Zealand Telecommunications Commissioner, after considerable analysis and debate, decided against recommending LLU for New Zealand, in large part because the effect upon metrics identified earlier in this paper, such as broadband penetration and investment in new infrastructures, was equivocal. These issues have been explored at length in the submissions made to the Commissioner during his analysis, so will not be repeated here. Further information can be obtained from the Commerce Commission webiste[45].

E-Readiness

Various measures have been used to measure ICT diffusion and explain its economic potential. Most analyses that endeavour to measure either the capacity or the potential for a country to gain productivity benefits in an information economy collate measurements of a large variety of indicative statistics, apply subjective weights, and derive a number upon which countries are then ranked. For example, the OECD uses a framework that recognises a time-based series of measures that reflect the readiness to utilise the infrastructures deemed necessary to participate in an information economy, the intensity of their use and their impact[46]. Likewise, 'scorecards' such as the Economist Intelligence Unit (EIU) *E-Readiness Rankings* and IDC's *Information Society Index* utilise a variety of indicators across infrastructure, technology availability, and the social legal, and government environments in order to determine the potential of a country to access productivity benefits in an information economy.

As the weightings applied, and the choice of metrics included and rejected is highly subjective, the rankings obtained tend to be of dubious value. Moreover, as the measures

[45]http://www.comcom.govt.nz/IndustryRegulation/Telecommunications/Investigations/LocalLoopUnbundling/Overview.aspx
[46] Outlined in Howell 2001, p 143.

included and rejected vary between years even for the same study, comparability becomes problematic. Nonetheless, the studies tend to attract considerable media attention, so are discussed here simply to illustrate their variability.

The EIU publishes a set of rankings for over 60 countries on the basis of their overall e-business environment, which reflects how conducive conditions in these countries are to the development and fostering of e-business opportunities. Nearly 100 quantitative and qualitative criteria are organised into six distinct categories that feed into the e-readiness rankings. The six categories (and their weight in the model) are connectivity and technology infrastructure (25%); business environment (20%); consumer and business adoption (20%); legal and policy environment (15%); social and cultural environment (15%); and supporting e-services (5%). Using the EIU's indicator, New Zealand improved its 'e-readiness' ranking from 18th to 17th in 2003, but fell to 19th in 2004[47].

The Center for International Development (CID) at Harvard University developed the Network Readiness Index (NRI) to assess "countries' capacity to exploit the opportunities offered by ICTs."[48] The NRI contains connectivity measures as well as enabling factors such as information infrastructure, hardware, software, ICT policy business and economic environments, network learning, ICT opportunities, social capital and networked economy measures such as e-government initiatives, e-commerce and general infrastructure. New Zealand's performance in 2003 was not very positive with its ranking falling from 11th in 2002 to 23rd and being highlighted as one of "the leading underperformers" (in terms of its NRI score compared with its level of ICT spending) and as having "a modest NRI score" given that it had the highest ICT expenditure (as a percentage of GDP) of all of the countries.[49]

Figure 32 shows New Zealand's E-Readiness rankings according to the IDC and EIU measures and CID's network readiness index.

[47] Economist Intelligence Unit and IBM Institute for Business Value 2004.
[48] Kirkman et al 2002, p 1.
[49] Dutta & Jain 2003, p 18.

Figure 32. New Zealand's E-Readiness Ranking

	IDC	EIU	NRI
Number of countries in survey	53	60	75
Ranking in 2002	17th	18th	11th
Ranking in 2003	6th	17th	23th

Adapted from: Howell *et al* 2004.

These various indicators provide 'snapshots' in time to gauge potential performance in the information economy and it is claimed that they are used by foreign investors to assess investment opportunities. Furthermore, they often form the stimulus for legislative and regulatory intervention, not because there has been a real problem identified, but in order to 'solve the ratings problem'. However, such practices are dangerous as they measure only two of the elements considered in this paper – connectivity and capability. In isolation from uptake, they are poor predictors of performance. Indeed, they are also poor summarisers of connectivity and capability too, as the two studies here cite significant falls in New Zealand's performance that do not appear to be supported by the statistics discussed here. However, as both weight broadband connections and local loop unbundling heavily, it is likely that these factors disadvantage New Zealand significantly, despite the considerable body of evidence that suggests these are not significant disadvantages to the development of New Zealand's electronic economy.

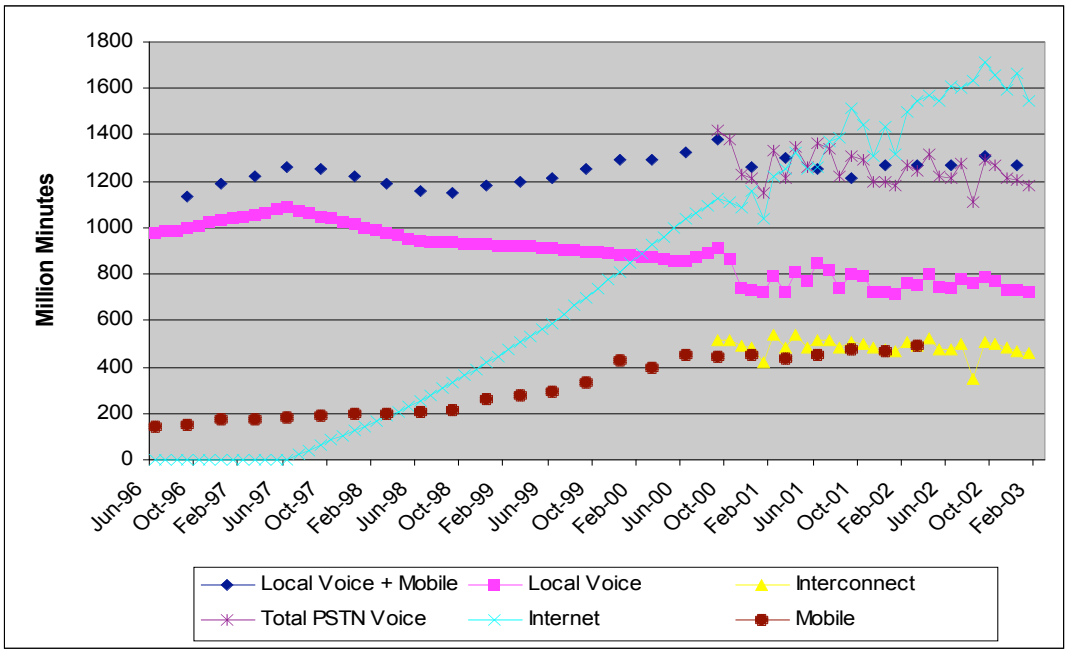
Uptake

Whilst connectivity and capability measures provide indications of the potential to gain benefits from an 'e-economy', the benefits will accrue only if the connectivity and capability are utilised. This requires the presence of benefit-generating applications that utilise infrastructure and other capabilities. Thus, it is important to understand what applications people are using technology for and the benefits that they accrue from its use in order to forecast the future of e-New Zealand. If the benefits are present, then the connectivity will be utilised at the prices at which it is made available. If the benefits are not present, or are less valuable than other uses to which consumers can put the resources, then connectivity and capability will not lead to uptake (or utilisation) of the connections or capabilities. Without utilisation, the benefits will not accrue. It is for this reason that this report takes uptake (utilisation) as the primary proxy measure for benefits to accrue.

Telecommunications

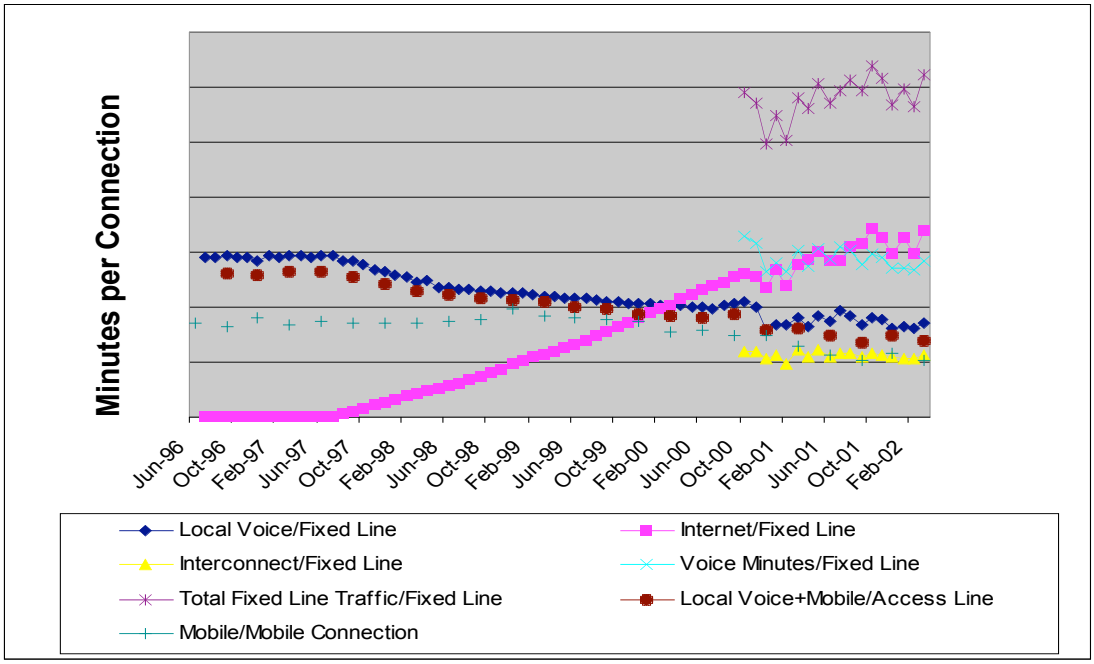
The Connectivity section details the maturing telephony market for connections, both in respect of fixed lines and mobile connections. Figure 33 shows that the market for voice communications is also maturing, in respect of the number of minutes of voice transfer being consumed. Total minutes per month are increasing only for dial-up Internet traffic. Even mobile minutes have settled to a constant level per month.

Figure 33. New Zealand Telephony Network Traffic: 1996-2003



Source: Howell and Obren (2003:33)

Figure 34. Per Connection Utilisations: June 1996 – March 2002[50]



Source: Howell and Obren (2003: 35)

When minutes of telephony traffic are measured per connection per month, it is clear that in the period from June 1996 to February 2002, despite new accounts being connected (especially mobile and Internet accounts), the average monthly consumption per account is decreasing for all traffic except for dial-up Internet traffic. Thus, additional accounts are not leading to additional consumption of voice traffic. Rather, figures 33 and 34 together suggest that what is occurring is the same number of voice minutes are being distributed between an increasing number of accounts. Of particular interest is the substitution between fixed line and mobile accounts. Total voice traffic per access line (fixed plus mobile combined) is approximately constant from October 2000, suggesting that substitution of voice traffic between the two systems is occurring.

The utilisation patterns confirm that market maturity suggested by the number of connections is also evidenced in the service usage. New connections bring onto the networks consumers with less than the average monthly consumption, leading to a decline in the average consumption per connection per month. Moreover, the substitution between local voice (at zero marginal cost) and mobile (with positive marginal cost) suggests that where the application brings additional benefits (e.g. flexibility), then New Zealand consumers will pay a positive price even when a 'free' service is available.

[50] Minutes data on the Y axis in this graph have been suppressed to protect Telecom data confidentiality. Interconnect and hence total voice traffic are measured only from October 2000.

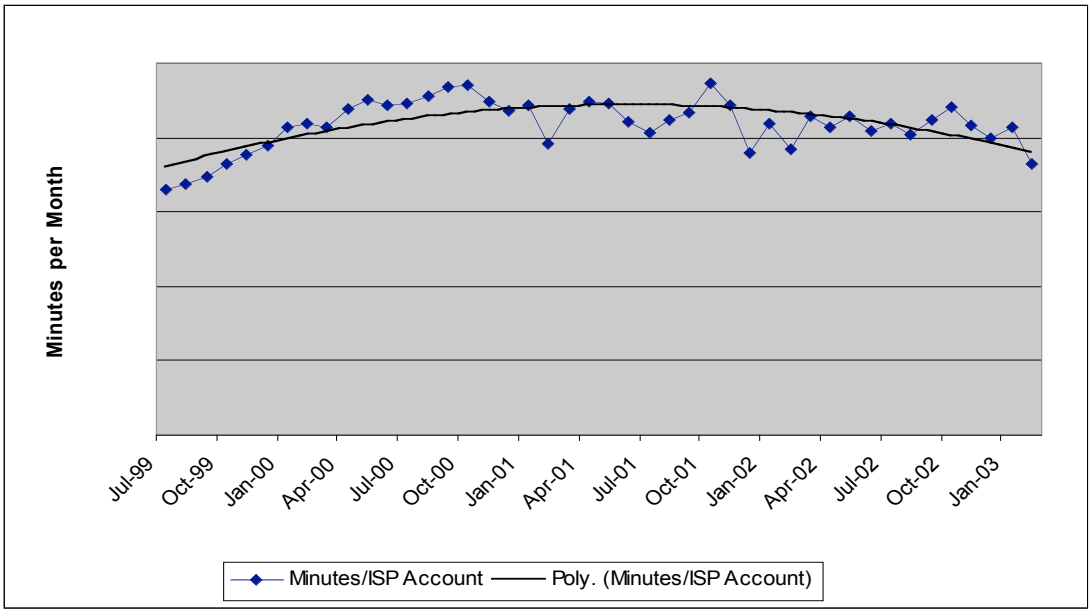
Personal Computer and Internet Use

The previous studies have shown that New Zealanders are not only amongst the most 'connected' populations in the OECD, but also amongst the most heavily using populations. International comparisons are difficult given the widening variety of technologies used. However, typically, hours per month of dial-up time and megabytes per month of broadband consumption provide some comparisons.

Dial-Up

Extending the data from figures 33 and 34 for dial-up Internet traffic shows a similar pattern to voice telephony. Figure 35 shows dial-up Internet access minutes (from Figure 33) per dial up ISP account. This shows that, although New Zealand dial-up consumers are consuming at the upper end of the OECD on a per account basis,[51] this market too is approaching maturity. New dial-up Internet account users are lower volume consumers than existing ones. Whilst in other jurisdictions, this pattern might be due to migration to broadband accounts by heavy users, in the New Zealand case, migration to broadband has been so low that this is unlikely to be significant.

Figure 35. Dial-Up Minutes per Connection Per Month: July 1999-Jan 2003



Source: Howell and Obren (2003:38)

Thus, even the dial-up Internet market is approaching maturity in respect of minutes of utilisation at around 30 hours per month or one hour per account per day. Howell and Obren

[51] Howell and Obren, 2003

(2003) argue that this is occurring due to the constraint on user time – for applications currently used, this is probably the maximum amount of time most people have available to spend physically connected to the Internet via a dial-up connection (given that this measures time actually connected, rather than the length on a session, which might include time not connected, for example when the ISP closes the call due to inactivity).

Broadband

International comparisons of broadband consumption are difficult to procure, as most data is proprietary to ISPs. Hence, international comparisons on this metric are not able to be offered in this paper. However, Howell (2003), using Xtra data based on the total consumption of a population of consumers purchasing a product, rather than surveys of perceived usage, showed that at that time, the average New Zealand residential broadband consumer with a package capped at 5Gb per month used 1500Mb per month. However, the median consumption was around 700Mb per month, suggesting that the average was very strongly influenced by a small number of heavy consumers, whilst the majority of broadband consumers were actually using only a very small amount of bandwidth per month. This implies that the applications used by the majority of broadband consumers at the time used low quantities of bandwidth. This leads to a tentative conclusion that in the New Zealand residential market at the time, most purchasers were presumably buying broadband connections due to their higher personal valuations of time rather than because they were regularly using applications that necessitated the higher transfer capabilities of broadband.

Whilst data is not available for New Zealand, the thesis that value of time and other factors such as the convenience of not tying up a telephone line, rather than specific Internet applications, determines broadband purchase is reinforced by Australian survey data. NOIE (2004: 40) cites NielsenNet survey figures summarising the reasons why Australian broadband purchasers surveyed chose the technology. Specific applications rated only 5th out of the 7 explanations, with only 20% of those surveyed stating this as a reason for purchasing, as opposed to 80% citing faster download speed, 60-70% (depending upon rural or urban location) citing freeing up a telephone line, and 60% citing no need to dial up. It is unlikely that New Zealand survey results would be very different. This appears to confirm that it is the valuation of personal time and convenience, rather than use of specific applications, that determines likely purchase.

Internet Applications Used

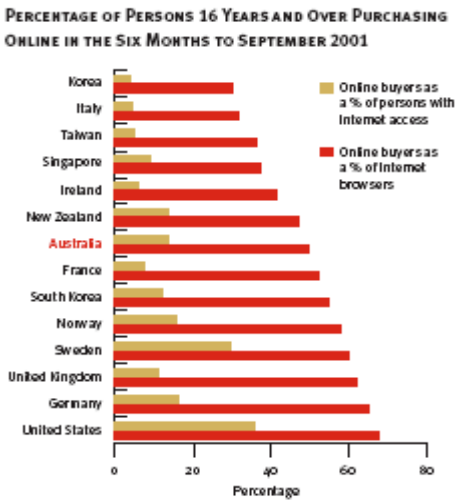
Given the ratios of the price of dial-up to broadband from Figure 25, the low broadband uptake and the typical usage patterns of the majority of New Zealand broadband purchasers, Howell (2003) and Howell and Obren (2003) concluded that it was likely a shortage of applications which New Zealand residential consumers valued sufficiently to pay the considerable premium for broadband over dial-up that was the most likely explanation for New Zealand's low broadband uptake. Combined with analyses such as Rappoport (2003) in the United Sates, showing negligible difference in the sites to which broadband and dial-up Internet connections are used to connect, with the exception of access to movies, gambling and gaming, this gives further credence to the thesis that it is the availability of cheap, high-quality dial-up that is depressing New Zealand broadband uptake, simply because the uses to which Internet access are put generally, and the value that consumers derive from the applications, are as yet insufficient to justify widespread uptake.

It is therefore informative to compare the use by New Zealanders of a range of applications to their international counterparts. If New Zealanders are engaging in the same types of activities, with the same frequency as those in other countries, then the benefits are accruing at least to the same level, irrespective of the Internet connection type.

Internet Purchasing

Internet purchasing is used as a measure of the extent to which a country is utilising electronic commerce. Figure 36 shows that in 2001, 14% of New Zealanders with Internet access purchased online and 48% of Internet browsers purchased products online.

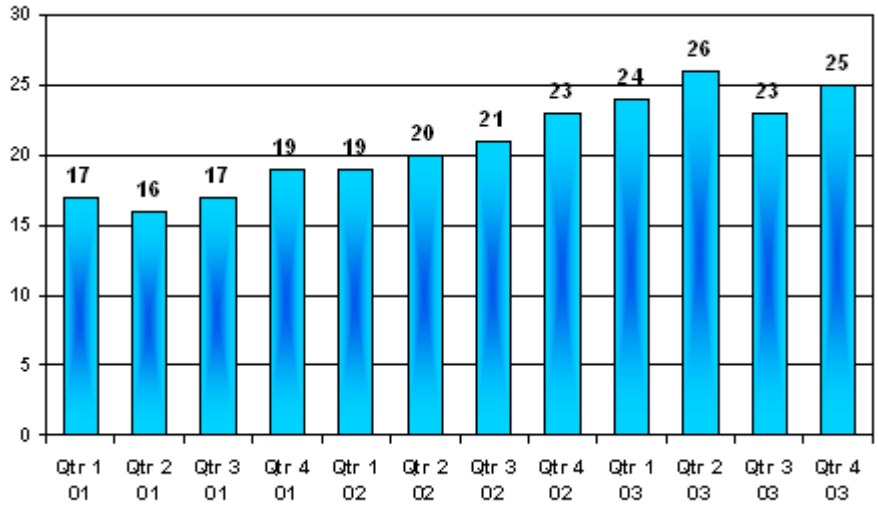
Figure 36. Online Purchasing 2001



Source:http://www.dpc.vic.gov.au/CA256D800027B102/Lookup/IPC-A-comms/$file/PART%20A%20COMMUNICATIONS.pdf

Figure 37 shows that Internet purchasing had increased 32% in the two years to 2003. In the last quarter of 2003, 25% of regular Internet users (representing 531,000 people) had made a purchase on the Internet in the last year.[52] This compares to 36% in Australia in 2004 (NOIE, 2004:16). Thus, it appears as though there is very little difference between the two countries in this statistic.

Figure 37. Internet Purchasing – Population 10 Years and Over



Source: http://www.acnielsen.co.nz.

Residential User Applications

Whilst online purchasing is commonly used as a measure of electronic commerce, the real value of the Internet, to residential consumers is access to information. Figure 17 (above) also shows that the majority of regular Internet use occurs in the home. In the last quarter of 2003, 52% (representing 1.7 million people) of Internet users reported Internet use from the home. Regular home Internet use increased 27% in the two years to 2003 and Internet use from work had steadily increased also. Of those in paid employment, 31% use the Internet at work regularly at Quarter 4 2003.[53]

Figure 38 shows that the top Internet activity (in the last four weeks – by percentage of those surveyed) in New Zealand in the second quarter of 2004 was Internet banking, followed by finding information on products or services. The remaining seven of the top ten Internet activities are separated by only 5 percentage points. It is noted that the Australian priority

[52] http://www.acnielsen.co.nz.
[53] http://www.acnielsen.co.nz.

list (NOIE, 2004: 18)[54] is somewhat different. Australians rated searching for service and product information and general surfing highest, with Internet banking rating 3rd. New Zealanders rated travel information more highly than Australians, whereas software downloading achieved a higher ranking in Australia. Accessing news and current affairs ranked lowest in both surveys. Notably, playing games only reached the top 10 in Australia for activities from sites other than home and work (e.g. libraries, Internet cafes).

Figure 38. Top Internet Activities: Q2 2004

Source: www.nielsen-netratings.com

Electronic Banking

It is notable that electronic banking appears to be a more highly used application in New Zealand than in Australia. The previous two reports show that New Zealand was an early adopter of the cash-less society.

[54] It is noted that, due to different survey mechanisms, the percentages of the New Zealand and Australian data are not directly comparable. However, the ranking can be validly compared.

As illustrated in Figure 39, the number of automatic teller machines (ATMs) continued to grow in numbers until 2002, but the rate of growth slowed to zero in 2003, which is consistent with the projection made by Boles de Boer *et al*[55] that an efficient number of terminals appeared to have been reached. EFTPOS transactions increased from 31% in 1998 to 35% in 2002[56] while the number of terminals has stabilised in recent years.

The number of telephone banking (IVR) transactions has slowed, falling from 24.5 million in 2000 to 19.5 million in 2003. However, as Internet and PC banking transactions have continued to grow, this implies that consumers are increasingly substituting telephone banking with Internet banking as more users become aware of the benefits of utilising Internet-based services, more familiar with the technologies and more confident that their transactions are safe.

Figure 39. Payment Methods (non cash) in New Zealand

	1999	2000	2001	2002	2003
Personal Computer	80,501,000	93,849,000	104,439,932	116,277,106	159,249,827
IVR	23,527,000	24,515,182	22,741,843	21,280,195	19,477,379
Bank Branches	873	849	832	1,098	1,103
ATM Machines	1,570	1,692	1,830	1,889	1,889
EFTPOS Terminals	77,892	84,351	92,840	95,221	98,474
Credit Cards on issue	2,073,884	2,289,505	2,547,629	2,653,153	2,374,391
Debit Cards on issue	4,116,763	4,195,259	4,392,770	4,697,289	4,668,276

Source: New Zealand Bankers Association 2003.

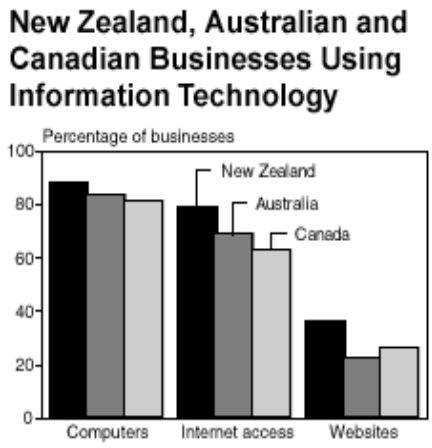
Business Use

As shown in Figure 40, 79% of New Zealand enterprises used the Internet and email and 36% operated a website in 2001. When compared to their Australian and Canadian counterparts, New Zealand businesses have a higher percentage of computers, Internet access and websites.

Figure 41 illustrates that most New Zealand businesses use the Internet to provide information about themselves, their products and services and as a medium for advertising. As Figure 41 also shows, this is consistent with the income generated by the services sector, which uses the Internet for sales and advertising.

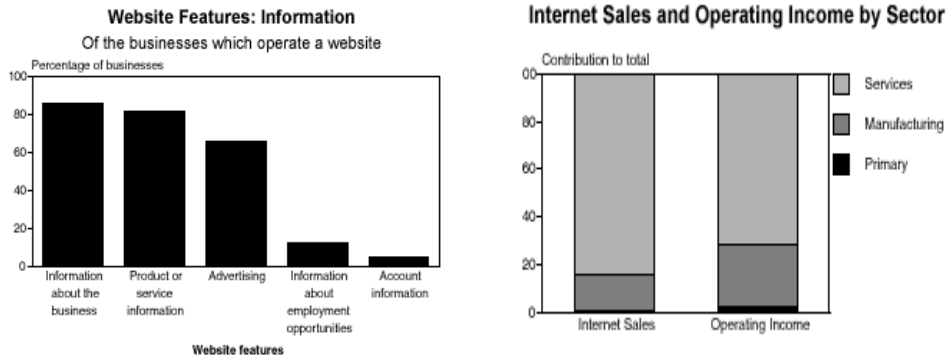
[55] Boles de Boer, Evans & Howell 2000.
[56] New Zealand Bankers' Association 2003.

Figure 40. Business Use of Computers 2001



Source: Statistics New Zealand 2002.

Figure 41. NZ Website Features and Operating Income by Sector: 2001



Source: Statistics New Zealand 2002.

Figure 42 compares New Zealand, Canadian and Australian business use of Information Technology in 2001. Whilst more recent data for New Zealand are not available, NOIE (2004: 16) shows that by June 2003, only 65% of very small and 81% of small businesses had Internet access. This compares to 80% of all New Zealand businesses in 2001. As more than 90% of New Zealand businesses are classed as small or very small, it is likely that New Zealand has maintained a significant lead over Australia in this metric over the period instanced. Likewise, by June 2003, only 25% of metropolitan and 20% of other Australian businesses had a website, compared to 36% in New Zealand in 2001.

These data tend to suggest that New Zealand businesses continue to enjoy an advantage of Internet usage over Australian businesses. Whilst Australian businesses exhibit higher levels of computer ownership (and hence use) than New Zealand, it is likely that New Zealand businesses are higher users of Internet-based applications. This would be consistent with the

statistics in the Connectivity section, which show higher numbers of secure servers and web pages per capita in New Zealand than in Australia. As together these statistics are indicators of business presence on and use of the Internet, then the extent of connectivity and utilisation measures are consistent with the impression that New Zealand continues to maintain a slight lead over Australia in terms of business use of the Internet. Without more New Zealand data, it is hard to determine the extent of that lead. However, the growth of Australia's Internet hosts per capita and its movement past New Zealand suggest that the lead may be reducing.

Figure 42. Business Use of Information Technology 2001

New Zealand, Australian and Canadian Businesses Using Information Technology(1)

	Country		
	New Zealand	Australia(2)	Canada(3)
	Percent		
Businesses using computers	88	84	81
Businesses with Internet access	79	69	63
Businesses with a website	36	22	26
Businesses that have used the Internet to sell goods or services	10	9	6
Businesses that have used the Internet to purchase goods or services	24	20	18
Value of Internet commerce as a proportion of total annual operating income	0.3	0.7	0.4

(1) Proportions are of all businesses.
(2) Source for Australian data: "Business Use of Information Technology (2000-2001)", Australian Bureau of Statistics, March 2002.
(3) Source for Canadian data: "Electronic Commerce and Technology Use (2000)", Statistics Canada, September 2001.

Source: Statistics New Zealand 2002.

Summary

New Zealand's uptake of electronic applications appears to be strong. The range of applications used, both in the business and residential sectors, appears to be consistent with those in Australia, although there is some evidence to suggest that New Zealand's early adoption of electronic banking, in the form of ATM and EFTPOS use, is converting to an earlier familiarity with, and adoption of, Internet banking, relative to Australia. New Zealand business use of the Internet appears to be slightly higher than that in Australia.

There does not appear to be any evidence to suggest that New Zealand's (or even Australia's) lower levels of broadband uptake are leading to significantly different uptake of applications, apart from Internet gaming, which appears to rank lower in Australia and New Zealand surveys of Internet use than in countries such as Korea and Singapore. Utilisation of applications that require broadband capacities appear to rank very low in the reasons for purchasing broadband connections. However, it is difficult to draw direct parallels between

utilisation rates in different countries, due to the different ranges of entertainment applications available in different markets. For example, gaming applications may rank lower in Australia and New Zealand as they compete for the entertainment dollar against activities such as sailing, participating in sport and camping, that are not available in other localities (Howell, 2003). Uptake of such activities in other localities may not be a good indicator of the welfare derived, if the choice set available to consumers is less. Australian and New Zealand consumers may be deriving greater welfare from the entertainment dollar by pursuing other activities, thereby leading to lower levels of utilisation of broadband, but not necessarily lower welfare.

Performance

The first two editions of *The State of e-New Zealand* suggested that, although performance was difficult to measure, a proxy lay in the consistency of the indicator measures, and the extent of utilisation (uptake) of applications. This third analysis reveals that New Zealand's statistics still continue to be consistent, and at the higher end of the OECD.

However, the statistics indicate a divergence that is beginning to appear between business and residential use of technologies. New Zealand has maintained high numbers of Internet users, secure servers, Internet hosts, web sites, businesses using the Internet and websites, and broadband connections. However, residential use of broadband is low. Both New Zealand and Australia have fallen down the ranks of broadband connections per capita since the last report. This has occurred despite price benchmarking that shows products that are competitively priced, especially given the low volumes of usage.

The poor broadband connectivity and usage figures appear to be the only factor by which these countries differ from the rest of the OECD. The question has to be asked – does it really matter in terms of economic welfare? Given that the applications which most people are using the Internet for do not appear to vary greatly from those in most other countries (except for gaming, movies and gambling), and that there is no evidence to suggest that business use of the Internet for value-enhancing information exchange is suffering from low residential uptake, in respect of measurable productivity gains, it may not matter very much. In fact, as the applications that require high broadband capability that are apparently being eschewed by New Zealanders are entertainment applications, low broadband uptake may well be a reflection of the fact that greater welfare is being enjoyed by New Zealanders from the consumption of entertainment products other than Internet-based ones.

In the meantime, where there are benefits to be gained from the use of electronic applications, businesses appear to be utilising them. Not only are secure server numbers per capita high, but links to secure servers on the .nz domain are also high, suggesting that these servers are indeed being used for significant numbers of transactions that require security. This is supported by the increasing numbers of transactions for Internet banking, and Internet purchasing. This is in contrast to a country such as Korea, where Internet and broadband connections per capita are high, but secure servers and web links are in the lower half of the OECD. Koreans individually may be well-connected, but what are the connections being used for? The evidence tends to suggests that secure cash and information transacting is not as widespread there as in New Zealand. Likewise, Hong Kong and Singapore exhibit high

levels of connectivity, but evidence of secure trading is lower in these economies where cash still plays a very large role in business and personal transacting.

Once again, we conclude that the consistency of the New Zealand statistics points towards the presence of performance benefits. New Zealand has maintained its position in the top third of the OECD in most statistics, and has slipped its ranking only slightly, if at all, in most indicators. The exception is broadband connections. However, New Zealand is not alone here. Australia, despite nearly double the growth of connections per capita as New Zealand, has slipped in its ranking too. This low ranking appears to be a function of the applications for which broadband is necessary. To date, none of these applications have offered compelling enough benefits to induce residential buyers to purchase the technology. This does not appear to be from lack of knowledge or use of the Internet, as New Zealanders are amongst the earliest and most ardent Internet users. It would appear that, given the current prices at which the technology is offered, and the applications that residential users value, other access methods offer the greatest benefits to residential consumers. Consumer sovereignty is sending an important information signal which cannot easily be ignored.

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