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

The State of e-New Zealand

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September 2000

http://www.iscr.org.nz/research/

Acknowledgements: *This paper was prepared as a background paper for the New Zealand Ministry of Economic Development's E-Commerce Strategy September 2000. Neil Quigley provided useful comments on an earlier version of this paper.*

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Issue and Methodological Foundation

In this paper we examine the mass uptake of open architecture systems for the electronic creation, transmission, storage and utilisation of information. We define electronic commerce as the use of these systems for commercial purposes, and we use E-New Zealand to refer to the utilisation of these systems in New Zealand. We use measures of infrastructure investment and utilisation to compare New Zealand's position relative to the rest of the world. We also attempt to make some assessments of the relative degree of uptake of various sectors within New Zealand. The purpose of this work is to provide a foundation for policy in a range of relevant areas based upon New Zealand's international position. The particular focus is on the extent to which infrastructure and industry arrangements are facilitating the optimal uptake of e-commerce.

In undertaking this analysis, we recognise that there are many dimensions to the massive changes brought about by commerce utilisation of these electronic infrastructures. Some of these dimensions relate to firms, some to central and local governments and some to individuals. Some relate to internal and some to external organisational structures and some will differentially affect producing units and consuming units. Many are shaping the evolution of society's institutions and rendering obsolete any sharp separation of commercial and consuming activities.

Many relevant dimensions are simply not measurable, or reliable indicators to assess them are not readily available. Predominantly, the outputs of electronic communication are intangible, and difficult to separate from the outputs of traditional commercial activity, especially as "traditional" merchants take up electronic means of trading. Furthermore, the increasing substitution of information for previously tangible inputs and outputs makes valuation of electronic commerce problematic.

Thus studies such as ours must be based upon those indicators of infrastructure availability and utilisation that are readily available, measurable and verifiable. This approach has been espoused by the Organisation for Economic Co-operation and Development (OECD), and has been used by the OECD, the National Office for the Information Economy (NOIE) in Australia, the Federal Trade Commission (FTC) in the United States and the Performance and Innovation Unit (PIU) in Britain in evaluating both relative and absolute states of electronic commerce preparedness and uptake.

The hypothesis which we maintain is that, if New Zealand is performing at the international forefront of infrastructure indicators, then there every reason to believe that, in the absence of any evidence to the contrary, it is performing well also in those areas where no measurable or reliable indicators of performance are available. Additionally, we propose that the available indicators should be interpreted in the light of the particular characteristics of New Zealand's economy.

Our analysis shows that New Zealand is not only much more e-ready than past studies have portrayed, but indeed already much more active in uptake of new infrastructures and technologies than past international comparisons have led us to believe. Internet participation figures show much higher levels of uptake than previously presumed. An analysis of export and import trading patterns goes some way towards rationalising the apparent inconsistency in the number of secure servers in New Zealand which has been used in earlier analyses to support the contention that New Zealand may be less well prepared for electronic commerce than its near neighbour Australia. Furthermore, New Zealand's extremely high level of EFTPOS and ATM adoption reinforces both a strong level of consumer comfort in the use of electronic technologies and significant business uptake where the cost-benefit trade-off is favourable and consumer demand exists.

Thus, although there are difficulties in measuring a continuously changing picture, it would seem that New Zealand is performing relatively well against the rest of the world in respect of all of the infrastructure indicators. By our hypothesis, we have good reason to believe that E-New Zealand, as a result of its strong infrastructural base, is indeed a world leader in uptake of electronic commerce.

The current state of E-New Zealand serves as a yardstick against which future performance and policy outcomes can be measured and evaluated.

E-New Zealand and Electronic Commerce

Although we focus on electronic commerce, we have deliberately chosen "E-New Zealand" in the title of this paper because electronic communications are changing transactions, and communications, costs and benefits in such ways and to such an extent that the distinction between firms and individuals as producers and consumers is shifting and increasingly blurred. Furthermore, electronic commerce is not simply a tool to facilitate the production and consumption process – it necessarily embraces all business-to-business, business-to-consumer and consumer-to-consumer[1] transaction activities.

There has been much public debate in recent months about New Zealand's readiness to capitalise upon the benefits promised by the emerging phenomenon of electronic commerce. Although the measures by which this can be reliably assessed are only just being developed, analysis of existing statistics has posed a contradictory picture. While New Zealand has figured prominently in international comparisons in measures of preparedness, such as the number of Internet hosts per 1000 people, measures of actual commercial uptake of Internet-based commercial activity, such as secure servers per 1 million people, have indicated that New Zealand lags some countries, such as Australia, over which it has an apparent preparedness advantage. This has led some to conclude that, while New Zealand is strong in its uptake of infrastructure and in its use of technology, a range of local factors - such as an internationally low research and development investment, difficulty in accessing venture capital, culture and level of educational attainment - are hampering development and utilisation of the business opportunities offered by new technologies[2]. There is also a perception that small and medium sized businesses (SMEs) are the most disadvantaged by this environment, and thus the least likely to be either participating, or planning to participate, in electronic commerce[3].

Conflicting and confusing assessments of New Zealand's state have arisen in part because of a lack of clarity in what "electronic commerce" actually is, and what statistics and benchmarks should be used to measure both relative and absolute performance. The picture has been further clouded by the speed of growth and evolution of the new technologies which facilitate electronic exchange, and the difficulties of separating out and independently measuring the key

[1] For example, smart cards.
[2] For example, ITAG's 1999 analysis *The Knowledge Economy.*
[3] For example, Ernst and Young, 1999. *e-Commerce in New Zealand: First Annual Study Results* p 7.

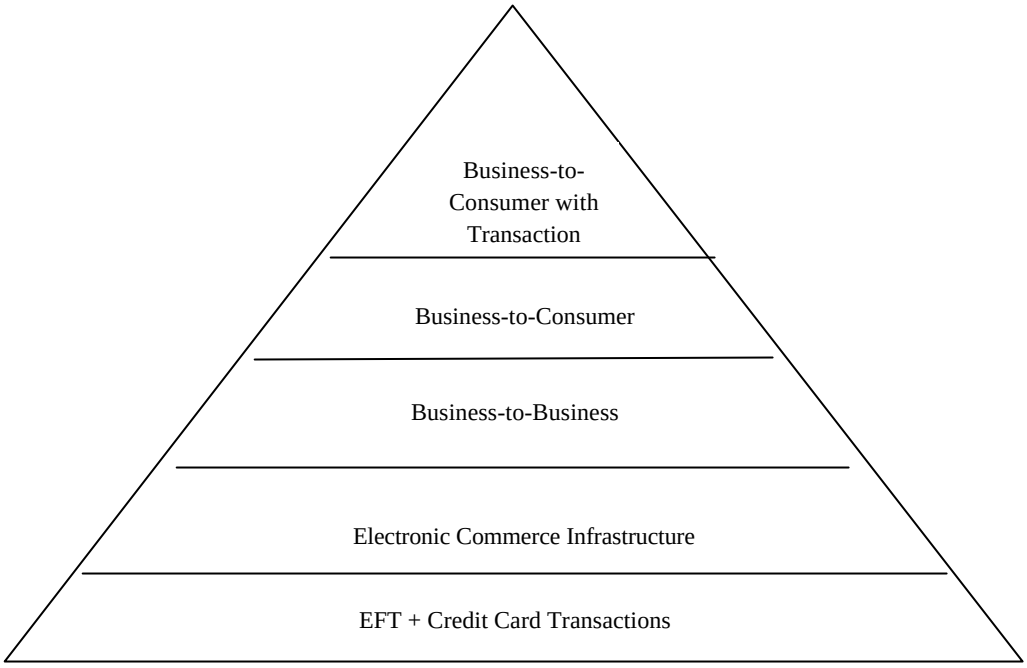
features which electronic exchange is enabling: convenience, variety, improved quality, timeliness and ease of access to information.

The purpose of this paper is to undertake a "stocktake" of New Zealand's current position. This requires a broad definition of "electronic commerce" which captures the activity of all participants, both firms and individuals. The definition we have chosen to use as the basis for this study is that of the OECD:

> "Electronic commerce refers generally to all forms of transactions relating to commercial activities[4], including both organisations and individuals, that are based upon the processing and transmission of digitised data, including text, sound and visual images."[5]

This definition allows us to include the broadest bases of electronic trading activity in our analysis, as illustrated in the OECD's Typology of Electronic Commerce Definitions (Figure 1).

Figure 1. Typology of Electronic Commerce Definitions.



Source: OECD Measuring Electronic Commerce p 19.

This typology clearly identifies, in the bottom two segments, the role of infrastructures as the foundation for all economic commerce activity that occurs. Without this infrastructural foundation being soundly laid, the ability for benefits to be realised from activities in the top three segments is compromised. Hence we have developed our hypothesis: that if New Zealand

[4] Which must involve consumers *and* producers.
[5] OECD *Measuring Electronic Commerce* p 6.

demonstrates world leadership in infrastructure, then a strong foundation for electronic commerce exists. Furthermore, unless there is evidence to the contrary, then we can assume that New Zealand is also at the international forefront in the development and use of applications built upon this base. Assessment of New Zealand's position should take account, where relevant, of this country's peculiar characteristics.

Our study is based upon publicly available sources of information. Internationally published statistics have been used to supplement New Zealand data to assess New Zealand's relative position. While international studies have provided some basis for comparison, the supplementary information sourced for this study has enabled a more complete picture of New Zealand to be painted.

The infrastructures we examine to make our assessment of E-New Zealand are those of Internet penetration and uptake, the electronic banking backbone of the payments system and the telecommunications environment. We then use this base to explore the extent to which this infrastructural base is utilised in electronic commerce applications. While we acknowledge that it is limited by the shortage of reliable and publicly available information, this analysis enables us to postulate some explanations for apparent and observed behaviours which may have led others to conclude that, despite the infrastructural advantage, New Zealand's application uptake is not as advanced.

Summary of Findings

Our analysis shows that New Zealand is not only much more ready than past studies have portrayed, but indeed already much more active in uptake of new infrastructures and technologies than past international comparisons have led us to believe. Examined through a different, less opaque lens, Internet participation figures show much higher levels of uptake than previously presumed. An analysis of export and import trading patterns goes some way towards rationalising the apparent inconsistency in the number of secure servers in New Zealand which has been used in earlier analyses to support the contention that New Zealand may be less well prepared for electronic commerce than its near neighbour Australia. Furthermore, New Zealand's extremely high level of EFTPOS and ATM adoption reinforces both a strong level of consumer comfort in the use of electronic technologies and significant business uptake where the cost-benefit trade-off is favourable and consumer demand exists. Thus, although there are

difficulties in measuring a continuously changing picture, it would seem that New Zealand is performing relatively well against the rest of the world.

Recent OECD research[6] indicates that the high readiness and consequent uptake have resulted from the existence of a telecommunications environment characterised by very high penetration rates, un-metered local-loop service, infrastructure competition and competitive development of high-speed access options. We contend that this environment and the characteristics of Internet Service Providers (ISPs) have predisposed the development of a highly competitive ISP industry which is also responding with "always on" internet access packages priced significantly lower than those available in Australia, and over some access time ranges, lower even than those offered in the United States.

Furthermore, although empirical research into regional and business sector uptake and application patterns is very new, there is growing body of evidence that New Zealand businesses are responding to the opportunities offered by this infrastructure. Early results indicate that uptake of Internet applications, particularly email, between businesses and customers, is widespread.

This leads to the conclusion that, at the current point in time, far from being a tardy participant, New Zealand is actually among the world leaders in uptake of electronic commerce, and potentially offers a conducive environment for the development of new ways of trading electronically.

However, continued electronic commerce development and maintenance of a world-leading position, in the face of continually changing technologies, rely upon retention and enhancement of the infrastructure environment that has encouraged the current position. Future policy developments must take cognisance of this finding – any changes which limit or decrease options will undoubtedly result in restrictions to continued electronic commerce growth[7]. Thus, it is important that electronic commerce developments be nurtured by the existence of a relevant and conducive policy environment flexible enough to embrace the demands of changing technologies

[6] Organisation for Economic Cooperation and Development Directorate for Science, Technology and Industry Committee for Information, Computer and Communications Policy Working Party on Telecommunication and Information Services Policies. July 27 2000. *Local Access Pricing and E-Commerce.* Paris:OECD. http://www.oecd.org/

[7] Importantly the OECD urges against taking a "retrograde step that would return policy makers to setting telecommunications tariffs". OECD *Local Access Pricing and E-Commerce.* p5.

and drivers, rather than by enshrining into regulation prices and strategies based upon the qualities of a limited number of existing technologies.

Internet Readiness and Uptake Indicators

Although there are no absolute and reliable indicators available to measure readiness and uptake of electronic commerce[8], there is a general consensus that the indicators used by the OECD to measure relative penetrations of internet usage provide a satisfactory proxy for in particular business to consumer transactions and transactions between small businesses lacking the resources to invest in closed systems[9]. Taking into account the small average size of New Zealand businesses and the absence of any other data collection and indicators, it has been generally considered that such figures should therefore also provide a good indication of New Zealand's overall electronic commerce preparedness and usage. Given this assumption, the figures used by the OECD[10] to measure Internet infrastructure:

- Internet hosts per 1000 inhabitants
- domain name registrations, and
- secure web servers per 1 million inhabitants.

have featured prominently in comparative analyses of New Zealand's position against its major benchmarks and competitors (e.g. MED (2000), ITAG (1999), Ernst and Young (1999). These statistics have also been extensively relied upon in analyses of Australia's comparative positions (e.g. NOIE Current State of Play, 2000 and 1999).

Analysis of these figures shows New Zealand to be among the world leaders in all of these measures of Internet readiness and uptake. This implies that a strong foundation for economic commerce participation in New Zealand has already been laid, and that New Zealand is at least as well placed as any of the other leading countries to build upon this open network Internet foundation to yield future benefits[11].

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[8] "Tracking which firms add how much value at what point in the chain of activity that represents electronic commerce is a daunting task. The World Wide Web (WWW) whose key features is the hyperlinks that allow users to jump quickly from site to site is likely to be the main applicatin for electronic commerce on the Internet." OECD Committee for Information, Computer and Communications Policy. 1997. *Measuring Electronic Commerce*. OCDE/GD(97)185. Paris: OECD. p 8.

[9] OECD Committee for Information, Computer and Communications Policy. 1997. *Measuring Electronic Commerce*. OCDE/GD(97)185. Paris: OECD.

[10] OECD Working Party on Telecommunications and Information Services Policies. 1998. *Internet Infrastructure Indicators.* DSTI/ICCP/TISP(98)7. Paris: OECD.

[11] "A better understanding of Internet infrastructures is an important element underpinning wider issues bearing on electronic commerce. They can provide a better understanding of the challenges for the private sector in upgrading infrastructure and of comparative national performance. They also provide an important input into a better

Internet Hosts per 1000 Inhabitants

Internet hosts per 1000 inhabitants reflect the number of hosts (computers) connected to the internet by counting domain names that have an associated IP address. This captures any computer system connected to the Internet (via full or part-time, direct or dial-up connections)[12] such as www.iscr.org.nz. The OECD figures reported in Table 1 come from the Network Wizards survey, which includes all Top Level Domains (TLDs)[13] and generic Top Level Domains (gTLDS) registered in each country.

Table 1. Internet hosts per 1000 inhabitants

	Jul-95	Jul-96	Jul-97	Jul-98	Jul-99	Jan-00	Change (Jul 1999-Jan 2000)
Finland	22.5	55.3	67.1	104.0	122.7	148.1	25.4
United States	14.0	26.2	37.2	78.1	118.0	141.5	23.5
Iceland	25.6	40.5	52.6	77.1	108.2	137.0	28.8
Norway	16.1	29.4	50.1	77.0	92.8	120.3	27.6
Sweden	14.6	26.3	39.7	62.1	96.0	114.8	18.9
Canada	14.0	25.2	38.7	73.4	93.6	111.1	17.5
Denmark	9.0	18.8	32.0	51.1	73.4	92.7	19.3
New Zealand	12.3	21.7	42.5	49.6	59.2	88.1	28.9
Netherlands	9.9	16.3	25.5	42.0	56.9	84.8	27.8
Australia	12.2	23.3	40.6	45.5	60.2	77.3	17.1
Switzerland	10.6	17.9	25.6	41.3	59.6	76.1	16.5
United Kingdom	6.0	12.1	18.1	28.2	43.7	60.3	16.6
Austria	5.6	9.9	12.4	20.2	35.5	50.0	14.5
Belgium	2.8	5.3	10.0	19.1	36.8	49.2	12.4
Luxembourg	4.9	9.5	12.8	23.6	38.1	43.5	5.4
Ireland	3.3	7.1	10.8	16.6	28.8	36.4	7.7
Germany	4.8	7.9	12.4	18.4	25.6	34.0	8.4
France	2.5	4.4	6.6	11.4	22.7	29.8	7.2
Japan	1.4	4.2	8.0	11.8	18.1	25.8	7.6
Spain	1.5	2.6	4.6	9.9	16.2	22.8	6.5
Italy	1.1	2.6	4.6	8.0	12.6	18.9	6.3
Korea	0.7	1.5	3.5	5.4	8.5	18.8	10.3
Hungary	1.2	2.6	3.5	7.7	10.3	14.2	3.9
Portugal	1.0	2.0	2.2	5.4	8.1	12.8	4.7
Czech Republic	1.5	3.2	4.9	6.7	9.4	12.8	3.4
Greece	0.6	1.4	2.1	4.4	8.1	9.6	1.5
Poland	0.4	1.0	1.2	2.6	4.4	6.0	1.6
Turkey	0.1	0.3	0.6	1.0	2.6	5.4	2.8
Mexico	0.1	0.3	0.4	1.1	2.7	5.0	2.2
OECD Average	5.9	11.2	16.8	31.4	47.1	59.3	12.2

1. These data are based on a survey undertaken by Network Wizards for the Internet Software Consortium (ISC). Internet hosts under generic top level domains (.com, .org and .net) have been reallocated according to the

understanding of how the Internet is becoming more critical for overall economic and social development in OECD countries." OECD *Internet Infrastructure Indicators* p 6.

[12] OECD *Internet Infrastructure Indicators* p 8.

[13]Top Level Domains are a specific grouping of domain names within the Domain Name Register. These are collated either on a country basis (e.g .nz represents New Zealand-registered names) – that is, country TLDs (ccTLDs) or on some other non-national basis, such as .com, which are known as generic (gTLDs) TLDs.

proportion of gTLDs registered by users in each country. The registration data for January 2000 was contributed by Matthew Zook.

Source : ISC, OECD. *Local Access Pricing and E-Commerce*. July 2000.

Table 1 shows New Zealand ranked 8th in the world in 2000 on this statistic (88.1 hosts per thousand inhabitants (1998 7th)), behind the United States, Canada and most Scandinavian countries (although New Zealand is close to but one of these countries), but ahead of Australia (77.3, 10th in 2000; 45.5, 9th in 1998) and well ahead of the UK. New Zealand is significantly above the OECD average both in the number of hosts (59.3 in 2000) and the percentage increase between 1999 and 2000 (NZ 28.9% against the 18% OECD average. New Zealand's percentage increase in Internet hosts between 1999 and 2000 is the highest in the OECD, significantly in excess of the United States (23.5%), the United Kingdom (16.6%) and Australia (17.1%).

Thus, by this measure, New Zealand is both a world leader, and improving more quickly than all other OECD nations.

However, it is acknowledged[14] that the Network Wizards data, based upon domain name registrations, may misrepresent individual country measures as the allocation of generic TLDs to each country is done using the proportion of gTLD registrations made from a particular country. Another methodology, developed by Telcordia[15], records in samples of actual daily usage the IP address, and hence the country of physical operation, of hosts using generic TLDs, irrespective of the country of registration. When gTLDs are reallocated under the Telcordia methodology, the hosts figures in Table 2 are derived.

The key feature of this allocation method is that, although the rankings of the countries does not change significantly (in 2000 New Zealand moves up one place to 7th), there is a significant reallocation of hosts away from most countries towards the United States. *The Internet host penetration rate of the United States rises and the rates of all other countries fall*. Two possible reasons exist for this: either

1. while users *register* significant numbers of generic (e.g. .com) addresses, they prefer to *use* hosts located under specific country code TLDs; or
2. users are utilising foreign hosting services.

[14] OECD *Local Access and Telecommunications Pricing* pp 11-13.

It is generally considered[16] that the Telcordia methodology provides a more robust reflection of actual deployment of Internet hosts throughout the OECD area.

Table 2: Internet hosts per 1000 inhabitants: Telcordia Methodology

	Internet hosts per 1 000 inhabitants				Reallocated gTLDs as a proportion of country total		
	Sept 1997	Sept 1998	Sept 1999	Mar 2000	Sept 1997	Sept 1998	Sept 1999
United States	61.3	95.5	160.1	185.2	66.1	68.7	76.9
Finland	70.4	102.4	122.8	138.5	9.3	7.6	9.8
Iceland	n.a	76.1	96.6	n.a	n.a	-1.0	0.7
Norway	43.1	74.2	88.0	97.8	4.4	1.1	3.1
Canada	31.9	54.5	76.0	83.4	33.6	34.9	35.6
Sweden	36.6	47.8	69.1	79.7	8.0	8.1	14.2
New Zealand	35.7	51.8	63.1	78.6	2.8	0.5	4.4
Denmark	27.7	41.3	59.9	n.a	6.5	2.9	1.6
Australia	33.6	44.5	55.4	60.8	12.4	5.5	6.8
Netherlands	23.2	37.8	51.9	n.a	8.4	8.3	12.6
Switzerland	21.7	34.6	42.9	n.a	8.7	11.9	14.2
United Kingdom	16.7	25.4	35.3	40.8	12.0	11.5	14.7
Belgium	8.6	17.7	29.8	n.a	3.9	1.9	1.3
Austria	8.9	17.9	28.0	n.a	4.3	9.6	16.6
Germany	11.0	15.6	20.4	23.4	7.3	8.2	14.1
Japan	9.2	13.5	18.8	22.9	3.3	1.5	2.2
Ireland	0.0	11.8	14.1	21.4	n.a	8.1	6.9
France	5.7	8.4	13.2	15.9	6.6	7.5	9.7
Hungary	3.9	8.1	11.5	n.a	10.6	13.8	11.7
Czech Republic	4.7	7.3	10.6	n.a	6.0	5.3	2.9
Spain	4.3	6.5	9.6	12.8	4.5	6.5	8.9
Italy	3.8	6.3	9.3	n.a	5.1	2.7	5.4
Korea	2.4	4.2	6.9	9.1	7.8	9.2	11.2
Greece	2.9	4.2	6.6	n.a	5.5	2.0	0.4
Portugal	3.2	5.4	6.6	8.1	6.0	3.8	0.8
Poland	2.0	2.9	4.0	n.a	2.2	-0.1	0.8
Mexico	0.2	0.9	2.1	3.2	4.3	3.1	4.7
Turkey	0.3	0.7	1.2	1.5	5.6	14.5	14.7
Luxembourg	n.a	n.a	n.a	n.a	n.a	n.a	n.a
OECD average	22.0	34.3	54.4				

1. Telcordia data for 31 March 2000.

Source: Netsizer (Telcordia as reported in *Telegeography 2000*), OECD. *Local Access Pricing and E-Commerce*. July 2000.

While the position of New Zealand is affected somewhat by this reallocation process (the 2000 figure falls from 88.1 to 78.6), the Telcordia reallocation affects the New Zealand hosts figure far less than the Australian figure (see Table 3). New Zealand had a net loss of 12% of hosts[17]

[15] Formerly Bell-Labs.

[16] OECD *Local Access and Telecommunications Pricing* p12

[17] To predominantly the United States, but potentially also to other countries, reduced by any sites hosted in New Zealand for foreign-registered gTLDs and ccTLDs.

in 2000, while Australia had a net loss 27%. Significantly, though, in 1999 and 1998, there was a net gain in hosts to New Zealand under the Telcordia allocation. This suggests that there is probably:

- a much stronger preference to both register and use nzTLDs in New Zealand than, in Australia, for Australian use of auTLDs (or perhaps a New Zealand preponderance to eschew the use of gTLDs in the first place), and
- a greater use of New Zealand—based servers for gTLD registrations
- and for the 1998 and 1999 years a real cost advantage for New Zealand web hosts sufficient to attract offshore customers.

A further inference might be that there is also a greater use of foreign-based servers by owners of ccTLDs in Australia than in New Zealand[18].

Table 3: Comparison between Net Wizards and Telcordia Data

Internet Hosts per 1000 Inhabitants - Comparison of two methodologies

Network Wizards	**Jul-95**	**Jul-96**	**Jul-97**	**Jul-98**	**Jul-99**	**Jul-00**
US	14	26.2	37.2	78.1	118	141.5
NZ	12.3	21.7	42.5	49.6	59.2	88.1
Australia	12.2	23.3	40.6	45.5	60.2	77.3
%NZ-Aus	1%	-7%	5%	9%	-2%	14%
%US-NZ	14%	21%	-12%	57%	99%	61%
%US-Aus	15%	12%	-8%	72%	96%	83%
Telcordia			**Sep-97**	**Sep-98**	**Sep-99**	**Mar-00**
US			61.3	95.5	160.1	185.2
NZ			35.7	51.8	63.1	78.6
Australia			33.6	44.5	55.4	60.8
%NZ-Aus			6%	16%	14%	29%
%US-NZ			72%	84%	154%	136%
%US-Aus			82%	115%	189%	205%
% Difference Network Wizards - Telcordia						
NZ			19%	-4%	-6%	12%
Australia			21%	2%	9%	27%

[18] Evidence collected by the Australian Tax Office indicates that in August 1999, 6.5% of com.au web sites were hosted off shore (an earlier study indicated 9%) – *OECD Local Access Pricing and E-Commerce* p 15).

This leads to the conclusion that not only is New Zealand a world leader in Internet hosts per 1000 inhabitants, there is also a greater tendency for New Zealand TLD owners to both register and locate their hosts in New Zealand than is the case for Australian TLD owners[19]. So in this measure, not only is Internet penetration in New Zealand high by world standards, the New Zealand industry appears to be in a much stronger position than its counterpart in Australia with respect to meeting the demands of its users from onshore-located Internet hosts.

Domain Name Registrations

A second measure of Internet penetration and uptake is the Domain Name System (DNS). The DNS servers map literal Internet addresses (such as www.iscr.org.nz) to the IP addresses of user computers, thereby ensuring correct routing of messages to and from participants in the World Wide Web[20]. When an organisation connects to the Internet, it typically registers a Domain Name (usually based upon its trading name). A count of New Zealand's registered Domain Names thus provides a measure of organisational penetration. Again, due to cross-border registrations and names registered but not active, this measure is not definitive, but it is indicative.

As at February 1, 2000, 49,230 Domain Names were registered in New Zealand. This figure has been rising over the past four years, consistent with the rise in the number of Internet Hosts per 1000 people. Approximately 88% of these registrations have been made by commercial organisations[21]. By a number of comparisons[22], the rate of increase in New Zealand Domain names exceeds that of Australia, again consistent with the increase in Internet Hosts.

Together the DNS registrations and the Internet Host measures reinforce not only New Zealand's high level of Internet penetration, but also a level of penetration in advance of Australia's.

[19] This is likely to reflect that fact that New Zealand ISP costs are lower than Australia (see Enright et al) and most other countries (see later analysis)
[20] OECD *Internet Infrastructure Indicators* p 11.
[21] MED 2000 pp30-32
[22] OECD *Local Asset Pricing and E-Commerce* p 63, NOIE *Current State of Play 2000,* MED 2000

Secure Web Servers per 1 Million Inhabitants

Measures of penetration and uptake, however, do not address the question of how Internet connectivity is being deployed. The Internet might be used for the purposes of conducting trades and exchanges between purchasers and consumers and other business-related data exchange, or it could be used principally for recreational purposes (for example, "net-surfing", downloading free entertainment products such as MP3 files or conducting chat room conversations).

Traditionally, it has been assumed that if there is strong commercial uptake of Internet usage, then the level of secure socket layer (SSL) server utilisation for encrypted transmission over TCI/IP networks will be higher than if the Internet is being used for recreational purposes. This assumption is based upon the premise that commercial transactions have a greater requirement to protect sensitive data (such as credit card numbers and industry data) from scrambling, loss and hacking than recreational transactions. The number of secure servers recorded by the OECD is considered a reasonably robust measure of each country's secure-server count, as software registration data (from which this statistic is collated) contains the user's business address, and hence the physical location irrespective of the country of registration of the domain name[23].

Paradoxically, despite having higher Internet penetration figures than Australia, New Zealand's uptake of secure servers, although still fourth in the world, has consistently been between 20% and 30% less than Australia's since 1998 (see Table 4). This has fuelled speculation (e.g. ITAG 1999, and Ernst and Young 1999) that despite having a higher Internet penetration than Australia, the New Zealand business community, and particularly the small and medium sector, has not embraced electronic trading as overwhelmingly as its trans-Tasman neighbour.

While there may be some validity to this conclusion, we contend that there are other plausible explanations for the measured secure-server position. As a small, open economy, New Zealand engages in significant importing and exporting. In particular, with respect to the types of goods most commonly purchased by consumers on the Internet (computers, books, clothing and entertainment[24]) New Zealand is by all methods of commercial activity, a net importer. Hence, given the ability of consumers to use the Internet to bypass wholesalers and importers, one might

[23] For example, the registration for www.amazon.com is Seattle, Washington, USA. This is also the site of registration for www.amazon.co.uk, because that is the physical location of that server.

assume that Internet-based purchases of these items by New Zealanders would be more likely to be from foreign rather than New Zealand-based sites[25]. In business-to-consumer trading, it would be the seller of goods who would be expected to maintain the secure server. Given New Zealand's typically high levels and variety of imports, consumer purchasing by Internet may very well be occurring, but on foreign-based secure servers, not New Zealand-based ones. Similar purchasing patterns could also be expected among business users who necessarily must import many of their inputs to production. In this scenario, New Zealand's secure server number could be expected to be lower than that in a market where proportionately more of these items are produced internally (e.g. books and entertainment in Australia).

Table 4: Secure Servers per 1 million inhabitants

	Sep 97	Feb 98	Aug 98	Feb 99	Jul 99	Jan 00	Mar 0
Iceland	36.6	36.2	47.1	100.5	104.1	161.6	193.9
United States	27.6	40.9	60.8	89.9	116.0	147.7	170.4
Australia	13.6	24.1	36.6	53.9	69.8	105.7	119.1
New Zealand	15.4	22.7	26.6	46.8	59.3	83.3	92.7
Switzerland	8.0	13.8	24.1	41.3	54.6	81.8	91.5
Canada	18.1	30.6	33.5	49.5	58.0	74.6	87.1
Luxembourg	7.2	9.5	28.4	42.2	61.0	75.1	86.8
Sweden	6.0	10.5	20.7	33.6	45.7	63.5	71.0
United Kingdom	6.0	9.2	14.0	21.3	29.5	47.4	55.2
Finland	3.9	7.4	15.7	24.8	34.8	47.8	54.4
Norway	5.2	9.5	14.5	22.7	29.3	44.6	49.3
Ireland	4.6	9.2	16.6	17.5	26.2	42.1	47.8
Austria	3.2	7.5	13.0	23.1	29.5	40.5	42.1
Denmark	2.1	5.5	10.1	13.8	21.2	33.7	39.8
Germany	1.8	4.0	6.8	13.2	19.8	29.5	34.5
Netherlands	4.8	6.8	9.4	15.5	19.4	25.8	29.4
Belgium	2.1	3.5	5.1	11.4	15.7	21.2	23.6
France	1.1	2.4	4.3	7.6	10.7	15.9	18.0
Spain	3.0	4.6	6.7	9.3	10.9	14.3	15.6
Japan	1.6	2.5	4.2	7.6	9.2	12.9	15.4
Czech Republic	0.6	1.3	2.5	4.5	8.6	10.6	13.0
Italy	1.5	2.7	3.4	5.3	7.5	9.6	10.8
Portugal	1.6	1.9	3.1	5.1	6.0	8.8	9.0
Greece	0.5	0.8	1.4	2.8	4.5	5.6	6.5
Hungary	0.7	1.1	1.9	2.4	2.6	4.3	4.9
Korea	0.4	0.7	0.9	1.9	2.3	3.4	3.3
Poland	0.2	0.2	0.7	1.2	1.6	2.5	3.1
Turkey	0.1	0.1	0.2	0.6	0.8	1.2	1.5
Mexico	0.2	0.3	0.3	0.5	0.6	1.0	1.3
OECD average	8.9	13.6	20.1	30.5	39.6	52.2	60.1

Source: Netcraft, OECD. *Local Access Pricing and E-Commerce*. July 2000.

[24]Both NOIE Current State of Play in Australia and MED in New Zealand

In addition, the size of the New Zealand market may also account for some of the disparity. As a small economy, New Zealand lacks access to some of the benefits accruing from economies of scale and the network effects of many electronic traders operating in the same market, which its larger trading partners enjoy. A small market does not have the capacity to support the large range of low cost product varieties that its larger counterparts can. Furthermore, New Zealand electronic traders face the disadvantages, due to banking restrictions and credit card company rules,[26] of having to trade in a volatile fringe currency. Foreign purchasers are wary about trading in such currencies, due to the potential of significant currency fluctuations between the times of ordering and payment processing by credit card companies[27]. These factors combine to make it more attractive in many instances for New Zealand companies to sell their goods through foreign-based agencies, thereby capitalising upon scale economies offered in larger markets, and avoiding the negative consequences of trading in the New Zealand dollar. Such behaviour will necessarily result in fewer secure servers located in New Zealand.

New Zealand's exporting patterns may also be compounding the comparatively low secure server number. Traditionally, by volume and value, New Zealand's export strength lies in its agricultural products. Export sales in these commodities are often channelled through "single desk" sellers known as producer boards[28]. This single focus for selling means that there has been little need for the small business suppliers to these sellers (e.g. farmers and growers) to maintain their own sales sites and hence their own secure servers to sell produce on a spot market, as output is pre-contracted to be purchased by the producer board. This doesn't mean that the produce from these suppliers may not ultimately be sold via Internet trading and secure servers. It may well be sold via producer board secure servers. However this method of coordinated selling means that fewer secure servers are required than if all the individual farmers were selling their produce directly[29]. As the single desk sellers also maintain offshore

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[25] Indeed, for personal purchases less than $400, there is an incentive for New Zealand consumers to purchase from abroad, as such purchases are considered of sufficiently low value not to be levied the 12.5% Goods and Services Tax.

[26] Currently, credit card company restrictions prevent New Zealand traders selling from New Zealand sites in US dollars. This is a significant disadvantage for, especially, small traders, as the only ways around this restriction are to either operate an American bank account, which requires US company registration, or have transactions vouched for by a New Zealand bank, which requires expensive software not as yet provided in New Zealand.

[27] Evidence provided by the Ministry of Economic Development indicates that this is a significant short-term problem for some traders.

[28] For example, the New Zealand Dairy Board and ENZA.

[29] Note that this does not imply that farmers and growers are not represented in Internet penetration figures – they may well use the Internet to communicate with the producer boards by email, to gain production-specific information and even to download information to the producer board. However, this may all be achieved without a farm-based secure server. Indeed, even information transfer for the purposes of coordinating production is more likely to be

trade sites (e.g. in the US, Europe or Asia) they may well also be utilising foreign-based secure servers. Such activity would further depress the New Zealand secure server figure, without necessarily impacting upon the level of Internet-based trading occurring.

In sum, the variety of goods imported is higher than the variety of goods exported, in part because of the strong role of producer organisations, lack of economies of scale, currency factors and credit card limitations. Hence it may be economically sensible for New Zealand to have lower numbers of secure servers relative to larger developed markets. Nevertheless, on a per head basis New Zealand is fourth highest world-wide and only just behind Australia.

Summary

Thus, by these measures of Internet penetration and use, New Zealand is already a world leader in Internet uptake. Furthermore, there is sufficient evidence to conclude that, despite apparently lower secure server numbers, New Zealand's penetration and uptake of commercial applications of the Internet is probably at least as high as, and possibly higher than, that of Australia's. If, as the OECD analyses indicate, high levels of Internet exposure and uptake are significant indicators of the extent to which the economic and social changes of electronic commerce are being implemented at an end-user level, then the comparative positioning of New Zealand as an electronic commerce world leader is beyond dispute.

flowing from farmers to processors rather than the other way around, in which case the need for secure servers is the recipient's.

Electronic Banking

While much emphasis has been given to Internet statistics as a measure of electronic commerce activity, it is also apposite to recognise that other methods of electronic commerce are also represented in New Zealand's commercial activities, and therefore should be measured. These include non-Internet-based computer processing activities (e.g. within Government departments such as IRD and Work and Income, and within substantial corporates such as Telecom and Fletcher Challenge) and other internal and external networks. In particular, some of the largest computer networks in New Zealand are maintained by the trading banks, for the purpose of transferring value between accounts held by individuals at the banks and by the banks at the Reserve Bank. The most significant of these is the system supporting cheque clearances, transfers, deposits and withdrawals via Electronic Funds Transfer at Point of Sale (EFTPOS) and Automatic Teller Machines (ATMs). Use of electronic banking interfaces is thus a very significant indicator of not just New Zealander's preparedness for, but their significant practical uptake of, electronic commerce, *even though this process is not driven by the Internet*[30].

The significance of electronic banking as both a measure and facilitator of electronic commerce activity cannot be overemphasised. Electronic banking provides the trading mechanism which has enabled information to become a perfect substitute for another product – cash. Within an electronic banking environment, information replaces paper, notes and coins (money) as the currency of the transaction[31]. Electronic trading of information about the transaction through bank accounts replaces the actual physical processes of exchanging cash between transactors and costly allied processes. Stores of information[32] now take the place of stores of money as measures of the value of transactions, enabling progress in the direction of a truly cashless society. However, the success of this substitution has relied upon the existence of an intermediary, trusted by both parties to the transaction – the banking sector – which acts as a broker in the exchange process.

[30] Although it is noted that the emergence of Internet Banking is opening up yet another electronic interface into this centralised system.

[31] See Howell (2000) for an argument that information transactions have the same characteristics as capital transactions and should be treated as such for taxation purposes.

[32] A store of information is a store of money so long as it represents a claim on value that a bank or other party will honour on demand.

The Role of a Centralised Banking Hub

New Zealand is unique among the nations leading the OECD Internet penetration and uptake figures in also having a centralised point of processing for the trading bank system. This began in the early 1970s when the major trading banks created the Databank system to manage such transactions. This joint venture centralised system, purchased by EDS in 1993, has provided the backbone off which the centralised ATM and EFTPOS systems have developed. The significant factor in both of these developments is that co-operation and participation in this system by all the major trading banks has ensured the maximum number of network nodes is effectively available to all customers. For example, customers of the National Bank can access money from the ATM machines owned by other banks such as the Bank of New Zealand, WestpacTrust and ASB Bank. It is also possible for institutions such as the PSIS to issue cards without owning any terminals or even being a bank. In addition, retailers installing EFTPOS terminals need install only one terminal which will accept the cards of all banks, thereby opening up this method of payment to customers of every bank. This is in contrast to, for example, Canada, where several discrete, non-interlinking bank networks exist, limiting the range of ATMs which a customer can use, and requiring merchants to maintain multiple EFTPOS terminals in order to offer electronic payment options to all customers, irrespective of which bank or network manages the account.

The joint venture centralised system thus enabled an early nation-wide rollout of first ATMs and then EFTPOS, while preserving competition at the retail end[33]. It is acknowledged that the initial motivation for the banks to develop the ATM network was to provide a cost-effective option to branch-based face-to-face teller services. It was not, and nor would we expect it to be, a broad objective to promote electronic commerce *per se*. Furthermore, the speed of the ATM rollout was facilitated more by the ability of the banks to share terminals and processing facilities and hence the infrastructure costs of this technological development than by burgeoning customer demand[34]. Nonetheless, the end result has been that the banks, by providing incentives to customers to use ATMs (by offering lower transaction costs to ATM, than teller, users) have precipitated a situation where New Zealanders, by and large, have become accustomed to, adopted, and adapted to, electronic means of both paying bills and accessing cash.

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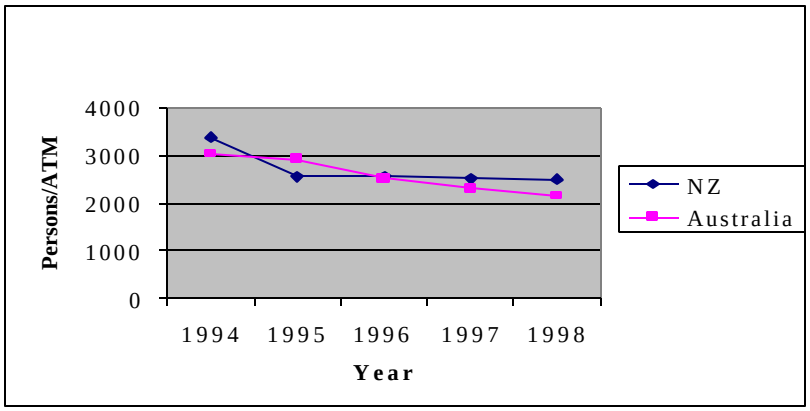
[33] Evans, Lewis, and Neil Quigley. 1998. *Common Elements in the Governance of Deregulated Electricity Markets, Telecommunications Markets and Payment Systems*. NZ ISCR Research Paper www.iscr.org.nz/research/.

[34] Indeed, in many areas there were significant customer protests at bank branch closures and "boycotts" of the newly introduced ATMs – e.g. Otaki in 1998-9.

ATM and EFTPOS Measures

Measures of both ATM and EFTPOS development and uptake reinforce New Zealand's world leadership in adopting both technologies. The number of persons per ATM[35] decreased steadily until 1995, when the number started levelling off, suggesting that perhaps an efficient level of terminals had been reached (Figure 2). This compares with figures for ATMs in Australia, which are still decreasing, indicating that the efficient number is yet to be achieved.

Figure 2. Persons per ATM



While it is acknowledged that the development of the ATM industry was originally bank-initiated, and could therefore be described, at least initially, as bank-led, the same cannot be said for EFTPOS[36]. The impetus for EFTPOS has been much more significantly merchant and consumer-driven. Unlike the ATM system, the capital cost of which has been met by the banks[37], the infrastructure expense for EFTPOS has been borne by merchants, with the incidence of all costs shared by all involved in the transaction[38]. Thus, it provides a good measure of the preparedness of, particularly, small and medium level enterprises in the retail sector to adopt electronic commerce technologies in the face of significant consumer demand for them. Our analysis shows that, with one EFTPOS terminal per 54 people, and 106 EFTPOS

[35] Source – New Zealand figures: KPMG *Banking Industry Figures* 1996-1999; Australian figures: NOIE *The Current State of Play* July 2000.

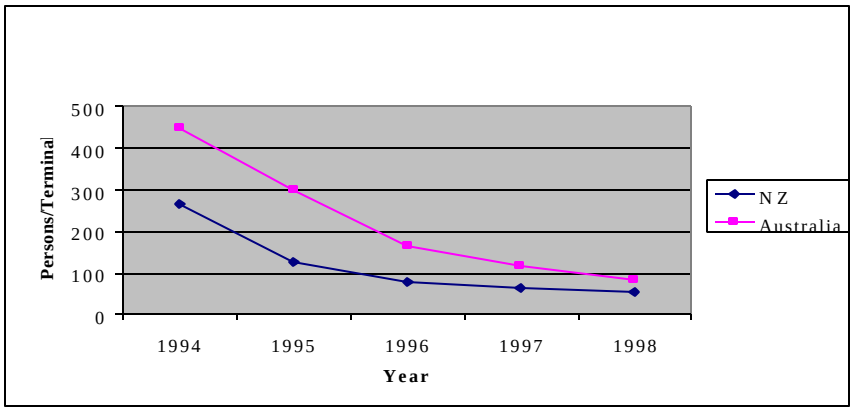
[36] Although it is acknowledged that ready consumer acceptance and adoption of ATMs, and in particular their willingness to substitute ATMs for tellers, made this bank-led rollout not only feasible, but also overwhelmingly successful.

[37] Albeit that the incidence of these costs have ultimately been shared between the banks and consumers.

[38] It is noted that both ATMs and EFTPOS are also electronic commerce applications of the banks, in that they translate into electronic form the interactions between the bank and its customers. EFTPOS in particular enables the banks' intermediary role to be played out in such a way that it is, at the time of the transaction, "invisible" to the two transacting parties. However, the transaction involves separate transactions between the vendor and his bank, and the customer and his bank. If the vendor also provides a cash withdrawal service for the customer, this is just anoter service that is being sold.

transactions per person per year (approximately one transaction every 3 days for every New Zealander), New Zealand leads the world in adoption of this electronic commerce tool[39]. This is significantly ahead of Australia at one terminal per 85 people[40] and 54 transactions per person per year (Figure 3).

Figure 3. Persons per EFTPOS Terminal



Further analysis of the comparative Australian and New Zealand figures (Table 5) shows that while the rate of increase in EFTPOS terminal installation in Australia is erratic, there is a much more stable, and declining, rate of increase in New Zealand. This tends to indicate that the New Zealand uptake of EFTPOS is being driven by the forces of merchant and customer demand, whereas in Australia, arguably the increase in EFTPOS terminals may be occurring due to other driving forces (e.g. bank-led reasons, government pressure resulting from the Electronic Commerce strategy to meet specified targets).

[39] KPMG 1997 p 16
[40] NOIE *The Current State of Play* July 2000

Table 5: ATM and EFTPOS Comparison: New Zealand and Australia

EFTPOS TRANSACTIONS (New Zealand)
(Source – KPMG Financial Institutions Performance Survey 1996-99 + Statistics NZ Population)

Year	Terminals	Terminals % inc	Number (million)	% inc	Value ($billion)	% inc	% of non cash xns	Popn (millions)	Persons/ Terminal	Trans/ Person	Trans/ Terminal	Value/ Trans
1993			70		3							
1994	13600		112.5	61%	4.6	53%		3.60	265	31	8272	40.89
1995	28700	111%	181.7	62%	7.8	70%		3.65	127	50	6331	42.93
1996	46360	62%	263.5	45%	12.7	63%	19%	3.71	80	71	5684	48.20
1997	59992	29%	343.5	30%	15.5	22%	25%	3.76	63	91	5726	45.12
1998	70424	17%	401.3	17%	18	16%	31%	3.79	54	106	5698	44.85

EFTPOS TRANSACTIONS (Australia)
(Source - NOIE Current State of Play July 2000 + ABS Population Statistics)

Year	Terminals	Terminals % inc	Trans/ month	Number (million)	number % inc	Popn (millions)	Persons/ Terminal	Trans/ Person	Trans/ Terminal
1989	15000								
1990	20000	33%							
1991	25000	25%							
1992	30000	20%							
1993	33000	10%				17.70			
1994	40000	21%	61	732		17.90	448	41	18300
1995	60000	50%	68	816	11%	18.10	302	45	13600
1996	110000	83%	78	936	15%	18.30	166	51	8509
1997	160000	45%	79	948	1%	18.50	116	51	5925
1998	220000	38%	84	1008	6%	18.80	85	54	4582
1999	265000	20%	90	1080	7%	19.00			4075

Market-Driven EFTPOS Adoption

There is significant anecdotal support for this conclusion. There are incentives for merchants to prefer EFTPOS to other non-cash payment methods. The instant confirmation of availability of customer funds insures merchants against the risks of being presented with subsequently dishonoured cheques. Immediate "real-time" transfer of funds offers significant cash flow advantages, and the transaction costs[41] compare favourably with the percentage charges levied by credit card companies on the transaction value[42]. Furthermore, the ability to dispense cash to customers reduces the level of cash held on the premises. The end result is increased employee safety and reduced cash handling charges, which retailers must pay to banks when depositing sums in excess of $1000, and reduced fees for security firms to physically move the cash. The widespread adoption of this technology shows that there is little aversion in the retail sector, at least, to adopting electronic commerce technologies when the benefits accruing demonstrably

[41] For example, the cost of hiring terminals, maintaining a telephone line and the call charge for the transfer.

[42] Indeed, there is evidence that low-margin retailers such as supermarkets have added incentives to offer EFTPOS over credit cards due to the existence of this charge.

exceed the costs. One could assume that this preparedness would transfer to adoption of other technologies should the same accrual of benefits exist.

Furthermore, significant demand from customers for EFTPOS facilities is encouraging retailer uptake. EFTPOS is increasing in popularity with customers who can combine their purchasing actions with their cash withdrawals, saving both time and the additional ATM or teller transaction costs. This is reinforcing an accelerated move towards a "cashless society"[43]. Despite an increased number of EFTPOS transactions over the past four years, the value of each transaction is stable at around $44. If this is driven by an increased purchasing component, then the cash withdrawn at each transaction is probably decreasing. This implies New Zealanders are using EFTPOS more and more frequently for small value transactions, and are hence becoming increasingly comfortable and familiar with non-cash transactions. This familiarity should be readily transferable to "cashless" Internet purchasing as well. Indeed, there is already significant evidence of customer willingness to engage in even more "remote" banking, with all of the major trading banks now offering customers both telephone and Internet banking options.

The almost ubiquitous presence of ATMs and EFTPOS demonstrates cogently that New Zealand retailers and, particularly, consumers have "re-engineered"[44] their cash handling and purchasing behaviour in order to achieve the benefits offered by the new technology[45]. The ubiquity of EFTPOS in New Zealand is important to the full range of consumer benefits it generates, and goes beyond that of other countries. This example demonstrates not only that New Zealanders have the capacity to adopt such changes, but also that, where mass uptake of new technology and re-engineering is required, this does not have to be progressed via a "big bang" single event, centrally planned restructuring exercise. Nor does it have to be consciously entered into by the participant whose processes are "being re-engineered". Where the benefits are real and mutual, and where the environment is not obstructive, then uptake can and will occur as an evolutionary process. This is an especially important finding for evolving "modern economies" where the trend is towards decentralisation and smaller units of operation, to the extent that the ultimate entity of commercial activity is the individual.

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[43] KPMG 1999 p 27

[44] This term is used extensively in Information Technology literature to describe the changes in organisational processes required concomitantly with the introduction of new technologies to yield maximum efficiency gains. See, for instance, the work of Hammer and Champy, as referenced by Brynjolfsson (1994) and Brynjolfsson and Hitt (2000).

Summary

The conclusions drawn from this paint a picture of an extremely sophisticated and e-literate retail and consumer sector in New Zealand, developed as a consequence of these banking sector technologies. The important role this process has played in preparing New Zealanders "culturally" for the emergence of the Internet and yet-to be developed electronic commerce mechanisms cannot be underestimated. Widespread use of electronic banking shows that, generally speaking, New Zealanders are comfortable with using not only keypads, visual display screens and secure passwords (PINS), but also with using a safe and secure "electronic information and money transfer system" operating through a central hub – just like the Internet. New Zealand's E-Commerce preparedness and uptake figures are thus doubly reinforced, both by the Internet penetration and uptake, and the central electronic banking system. Furthermore, there is significant evidence that New Zealanders are indeed more prepared and capable than their Australian counterparts.

[45] This is consistent with Brynjolfsson and Hitt (2000)'s assertion that the maximum benefits of technology will be achieved when the human systems around them are redesigned at the same time that the technology is introduced.

Costs: the Telecommunications Infrastructure Effect

As has been shown in the preceding analyses, New Zealand has already achieved a significant level of Internet penetration and usage, higher than that of Australia and most other OECD countries, and an uptake of ATM and EFTPOS applications which leads the world. These would not have been possible without a facilitative telecommunications industry, given the current technological reliance on telephony systems for both ATM and EFTPOS transacting and web access, and a burgeoning Internet Service Provider (ISP) industry to manage the web interface.

Development of the ISP industry in New Zealand is documented in Enright (2000)[46]. Further work by Boles de Boer, Enright and Evans (2000)[47] demonstrates that the cost of New Zealand ISP services not only has declined significantly over the past four years, but that the relative cost of such services in June 2000 is in some instances up to 30% cheaper in real purchasing power parity terms than comparable services offered by Australian providers. This is consistent with particularly the Telcordia host data penetration figures, which show approximately 29% higher penetration in New Zealand than Australia at March 2000.

The OECD Pricing Enigma Explained

However, OECD analyses have consistently shown New Zealand prices to be on average slightly higher than those in Australia (e.g. OECD figures cited in the NOIE Current State of Play 2000 show Australia's average price for 20 hours Internet access per month (1995-2000) at $US38 and New Zealand at $US42), the United States ($US34 for 20 hours) and Canada ($US30 for 20 hours). This appears counter-intuitive, given the higher New Zealand penetration figures, and inconsistent with the Boles de Boer, Enright and Evans (2000) study findings. However, recently released OECD research[48] reveals that on ISP charges alone, New Zealand rates are, in real purchasing power parity terms, significantly cheaper than those in Australia over all measured usages. Table 6 shows that New Zealand ISP charges range from 41% cheaper than Australia's over 20 hours access per month to 26.5% cheaper at 40 hours per month. Indeed, New Zealand ISP charges are less even than those available in the United States over some ranges – for instance 5% less at 20 hours per month.

[46] Enright (2000).
[47] Boles de Boer, Enright and Evans (2000).

Table 6 reveals clearly that the OECD Internet Access costs upon which historical analyses have been performed include *not only the ISP charge but also the cost of the telephone access to become connected to the ISP and hence the Internet.* It is in fact the OECD's purportedly higher costs of New Zealand telephony[49] and method of allocating these costs, and not ISP costs themselves, which have been inflating New Zealand's Internet access costs relative to those of other nations in the OECD analyses. Further investigation of the OECD figures reveals that they have priced the cost of telephone (PSTN) access at the full cost of telephone line rental at the Kiwi Share price, and thereby double counted this cost.

The OECD has long had difficulty with telephony benchmarks stemming from wide variations in tariffs, especially free local-call options, and associated wide variances across countries in the bundles of telecommunications services used. Using a standard bundle for all countries does not solve the problem, and can lead to misleading results, as can the use of posted tariffs. The only way to make a meaningful comparison where bundles differ greatly is to compare each country's average bundle of services at each country's set of transaction prices. Lovick and Clark (1999)[50], partially using this methodology, demonstrate that of a sample of the UK, Finland, Australia, Sweden and New Zealand, New Zealand residential telecommunications prices for a New Zealand consumption bundle, were the cheapest[51]. Indeed, the New Zealand prices were 28% lower than those of the closest rival, Sweden, and 44% lower than the most expensive, the United Kingdom[52].

We contend that the OECD methodology does not yield a sensible representation of real telephone Internet access costs when related to the purchasing patterns of New Zealand Internet users[53]. The OECD figures are based upon domestic Internet usage. New Zealand

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[48] OECD. 2000. *Local Access Pricing and E-Commerce*.

[49] A factor attributable to New Zealand's low population density and high consequent infrastructure costs, as per Alger and Leung (1999).

[50] Lovick, Sam and Emma Clark. 1999. *A Comparison of International Telecommunications Prices*. Network Economics Consulting Group Research paper. www.necg.com.au/papers.shtml

[51] For New Zealand tariffs to yield the lowest cost at the New Zealand bundle of services, it is necessary for New Zealand to have the cheapest tariffs in the study.

[52] The high-cost United Kingdom result in this study is quite remarkable given the cost differentials that can be expected on a population density basis alone – see Alger and Leung (1999).

[53] If this same methodology applies to the analysis of costs in other countries as well, then there can be little confidence that the OECD total Internet access costs paint an accurate representation of the true marginal cost, and hence reliable international comparison, of these services. If New Zealand's prices are lowest, then other countries' tariffs cannot be uniformly lower than those of New Zealand. Further investigation is required to determine if New Zealand tariffs are uniformly lower than those of other countries.

has a domestic telephone penetration of around 96%[54] and a mobile phone penetration in excess of 40%[55]. Assuming many of these current telephone subscribers would use their existing telephone lines to access the Internet[56], and New Zealand's "free" and unmetered local call pricing structure, then the marginal cost of the telephone link to the ISP for these consumers is zero. The illogic OECD approach is exemplified by the following example. Assuming country A has an access charge and no local calling charge, and country B has no access charge but does have a local calling charge, then the OECD methodology will accurately calculate telephony and internet access costs for country B. But by counting the access charge for each of telephony and ISP access, the combined cost for country A will be overestimated by a factor of 2.

Furthermore, both local line rental companies in New Zealand (Telecom New Zealand and Telstra Saturn) offer substantial discounts for second lines when sold in conjunction with access to their proprietary ISPs (Xtra and Paradise respectively). Given the significant market share of these two ISPs, and assuming that most rational Internet users requiring a second line will choose to utilise these discounted rental rates for second lines or utilise their mobile phone as a secondary voice message system, then the marginal cost even for two-or-more-link customers is still substantially less than the full cost of an additional primary land-based telephone line. Table 7 demonstrates that even in the event of a New Zealander requiring a second line, for example, to meet small home business or domestic household needs, rental discounts of the order of 18% to 50% are available. Furthermore, an Internet user with only one leased line utilising a pre-paid mobile phone with no monthly connection fee for incoming voice messaging[57] while connected to the Internet, also faces a marginal cost of Internet telephony of zero.

The combination of telephony purchasing patterns and lower ISP costs thus reinforces the significantly higher Internet penetration rates witnessed in New Zealand than in Australia. We contend that this provides additional evidence to support the argument that New Zealand is further advanced in readiness and uptake of the Internet, and hence electronic commerce, than Australia. Furthermore, the relative pricing of ISP services shows that New Zealand providers are amongst the most cost-competitive, and hence efficient, in the world[58].

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[54] MED (2000) in 1998 p 23.

[55] Verbal confirmation from Vodafone, Morning Report 14/08/00.

[56] The authors are included in this category.

[57] Where call charges are met by the incoming caller, not the Internet user.

[58] There are, however, some caveats to this statement. The OECD figures show that, although the "basket" of ISP services purchased in on average cost-competitive, the rates charged for high speed DSL services is, in purchasing power parity, one of the most expensive for a combination of connection, monthly service and equipment costs. (OECD *Local Access Pricing and E-Commerce* p 69 figures as at March 2000). However, it is noted that Telecom,

The rest of the Telco influence

Despite the cost disadvantages relating to low population density, the structure of the New Zealand telecommunications industry and its pricing policies over the past decade have had a significant, and until recently, a little-acknowledged role to play in the development of New Zealand's burgeoning electronic commerce, and particularly, Internet uptake, environment. Recent research by the OECD[59] attributes the high Internet penetrations and apparent electronic commerce uptakes to a combination of the high telephone penetration and the telecommunications pricing policies based upon unmetered local calling, of New Zealand, Australia, the United States and Canada. That is, in these countries there is no variable charge based upon the time spent on a local call, such as a domestic customer might make to access an ISP[60]. This, the OECD report claims, puts no time-based cost barriers upon users remaining "on line" to the Internet for extended periods.

Indeed, as we have identified, there is in fact an effective marginal cost of zero for most New Zealand residential Internet users, as there is no additional telecommunications charge, even in the form of a local per call access charge, as is the case in Australia and the United States. Extended Internet connection time is identified as the primary stimulant for electronic commerce on the Internet. Specifically:

- the difference in penetration of Internet hosts, between countries with metered and unmetered local telecommunication charges to access the Internet, is a multiple of 6.1
- the difference in the penetration of secure servers, between countries with metered and unmetered local telecommunication charges to access to the Internet, is a multiple of 5.8[61].

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the sole supplier of this service (Xtra Velocity) in New Zealand (it is dependent upon the quality of local loop connections, which are owned by Telecom) did reduce prices around June 2000. It is pertinent to note that DSL access is by no means universally available in New Zealand – Telecom lists it as being available through only 69 of its 200-odd exchanges (www.telecom.co.nz). A competitive high-speed cable modem service is offered by Telstra Saturn, but this is limited to the extent of Telstra Saturn's proprietary cabling in Wellington and some parts of Christchurch. DSL services are only just becoming available in Australia.

[59] OECD July 2000. *Local Access Pricing and E-Commerce*.

[60] In the United States, Canada and Australia, a fixed fee is charged for each local call made. However, in New Zealand, there is generally no additional charge for local domestic calls.

[61] Noting also that these prices for New Zealand are the high-end dedicated line charges identified in the previous section.

As illustrated in Figure 4, New Zealand, Australia, Canada and the United States sit almost alone in sharing these characteristics[62]. Furthermore, the growth of both Internet hosts and secure servers is significantly higher in countries with unmetered access – see Figures 5 and 6.

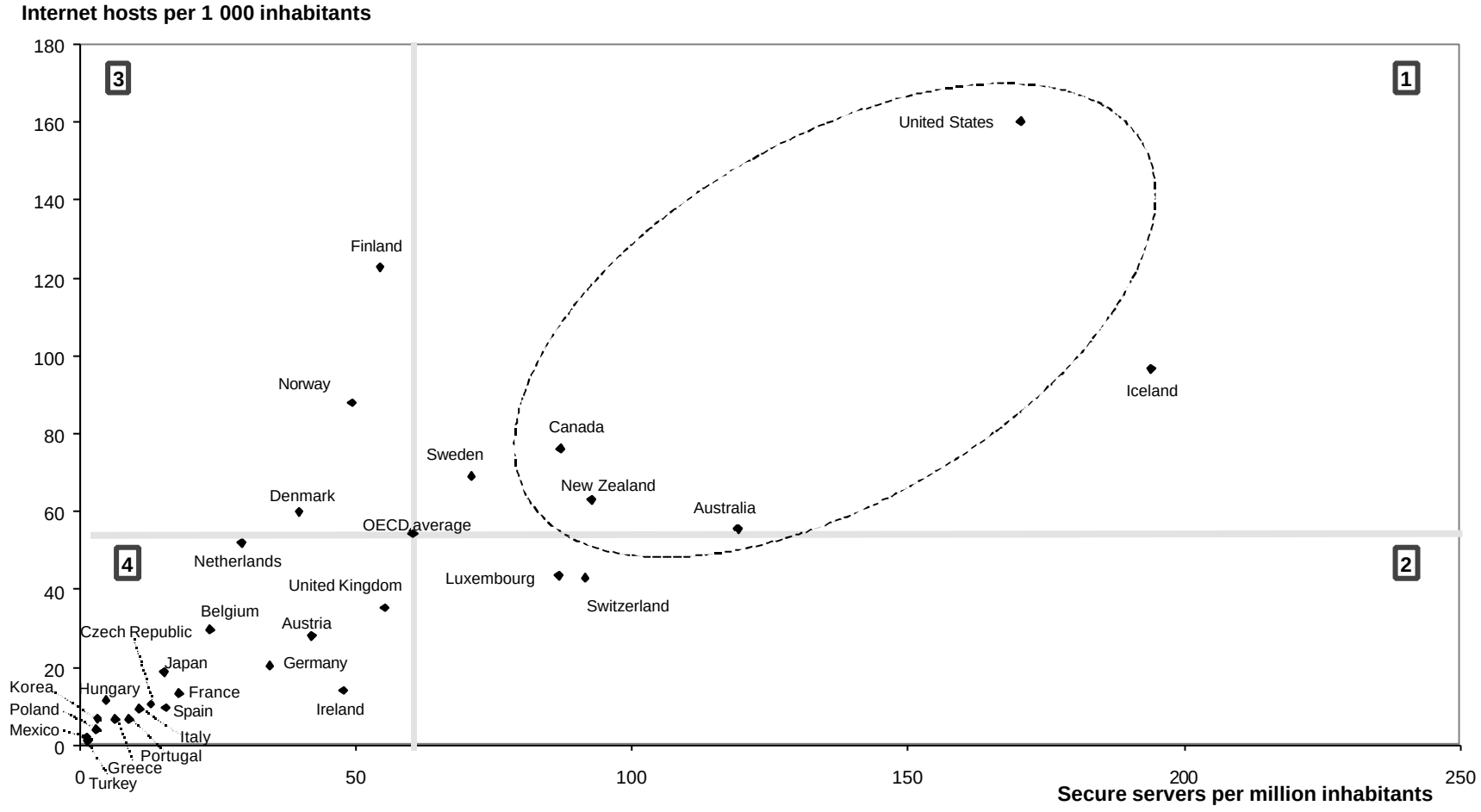
Consequently, growth of Internet usage, and particularly commercial usage, in these countries has been encouraged to a far greater degree than in other countries where a time-based call charge is levied, even though the zero-usage charge applies only to households. This helps explain why the Scandinavian countries, despite having high Internet and telephone penetration rates, do not figure as prominently in commercial indicators, such as the number of secure servers[63] – there is a consistent policy of charging for each minute of local call time in these countries. It also accounts for New Zealand and Australia in particular having secure server ratings several places higher than their Internet penetration figures (Table 3). Furthermore, it goes some way to explaining why the United Kingdom, which also has metered telephone calls, has not markedly increased its Internet penetration ranking despite increased telephony service competition, local loop unbundling and falling per-minute call prices[64].

[62] It is noted that Iceland stands out as an apparent exception to the rule of unmetered access in zone 1 of Figure 3. Iceland has metered call charges, but compares favourably with Australia, Canada, New Zealand and the United States in the OECD analysis. Two possible explanations exist for this. Firstly, Iceland's position is significantly influenced by its secure server number. However, there are only 54 secure servers in total for Iceland's population, meaning this positioning may be a consequence of small size and diseconomies of scale. (While it is noted that small size may also be a possible explanation for New Zealand, the total number of secure servers here is 352 – seven times the Iceland number, so therefore much less likely to be distorting the position.) Secondly, while Iceland does have metered calling, it may be that if metered charges are low enough, electronic commerce can still prosper. It is noted that in particular, Iceland and Sweden, the other "anomaly" in zone 1, have inexpensive options offering unmetered access to, and unlimited download capacity using, high speed access methods such as DSL (Iceland) and cable modems (Sweden). It will be interesting to monitor the relative performance over the next few years of other countries with metered calling, but recent introduction of unmetered high-speed access, such as the United Kingdom, to determine which of these explanations for Iceland is indeed the most credible.

[63] OECD *Local Access Pricing and E-Commerce* p 33.

[64] OECD *Local Access Pricing and E-Commerce* p51-52.

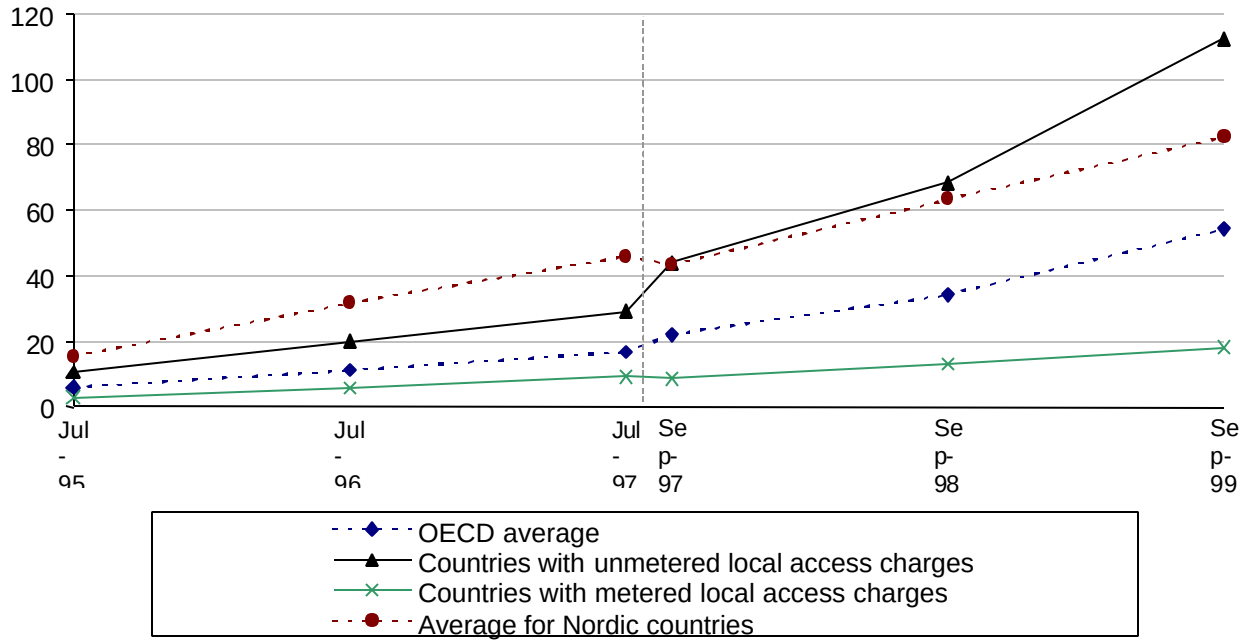
Figure 4. Always-on zones of communication (Internet host penetration and secure server penetration)



Note: Data on secure servers are from March 2000. Data on Internet hosts are from September 1999.

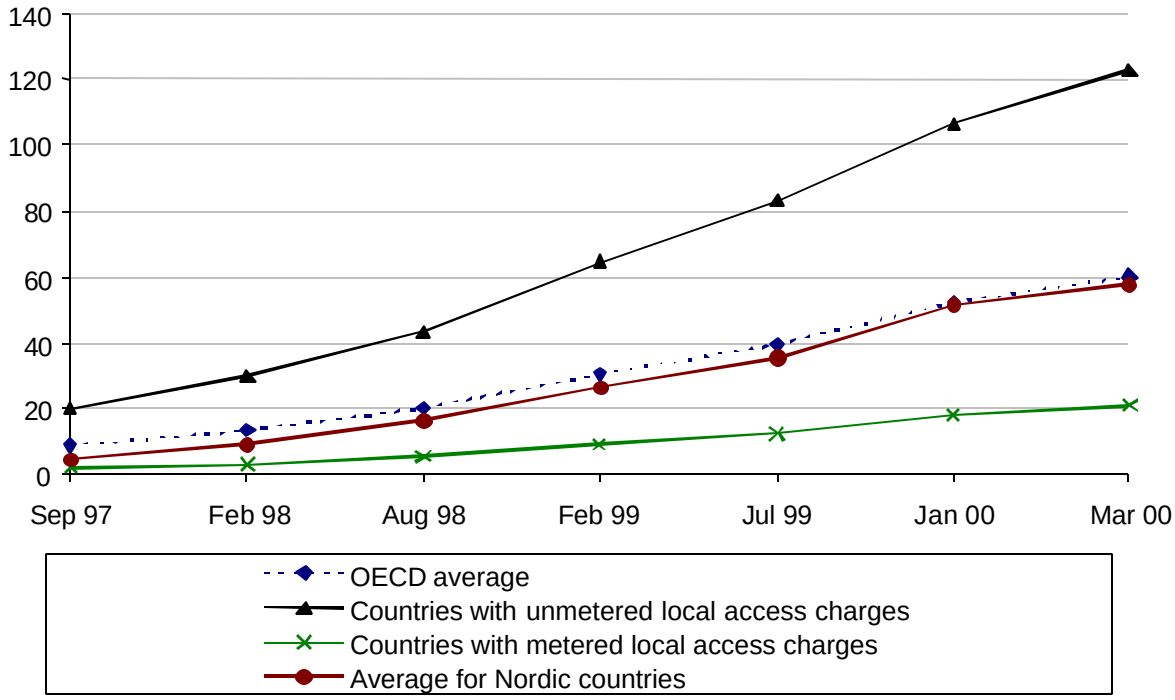
Source: OECD (www.oecd.org/dsti/sti/it/cm) based on Telcordia Technologies (www.netsizer.com) and Netcraft (www.netcraft.com).

Figure 5. Growth of Internet hosts in countries with metered and unmetered Internet access



Source: July 1995 to July 1997 data are from Internet Software Consortium (www.isc.org). September 199
September 1999 data are from Telcordia Technologies (www.netsizer.com).

Figure 6. Growth of secure servers in countries with metered and unmetered Internet access



Source: OECD (www.oecd.org/dsti/sti/it/cm) based on Netcraft (www.netcraft.com).

High-Speed Access – the next frontier?

While much of New Zealand's current level of electronic commerce preparedness and Internet uptake compared to the rest of the world may be attributed to unmetered local calling, this has been because the telephony component of access has been effectively removed from consumers' decision-making processes. Analysing trends in Internet access within the four countries with unmetered local calling reveals some interesting scenarios about New Zealand's ability to build upon its current position in relation to members of this peer group.

The preceding section has focused on PSTN access to the Internet, assuming that users require constant connectivity to dedicated telephone lines in order to participate in the Internet and electronic commerce. However, in reality, data transfer patterns vary vastly depending upon the type of transactions the user is engaged in. EFTPOS transactions, for instance, involve short bursts of two-way traffic down 64kb telephone lines. Some consumers require much larger amounts of data to be downloaded than they will upload themselves. And in some cases, intensive two-way data traffic may require dedicated lines. New value-adding telephony services are being continually developed to meet these changing information transfer needs. An example is the development of broadband services to meet high data transfer needs. Existing Internet service participants, facing the development of these new technologies, must decide when it is the optimal time to abandon the methods currently used and to invest in these new technologies.

Although they are still only in early stages of development as commercial Internet access methods, high-speed access tools such as Digital Subscriber Lines (DSL) and cable modems already appear to have created investment pattern distinctions between the four leading un-metered calling countries. DSL and cable modem services differ from the standard dial up Internet access services in that they can distinguish between transfer rates for uploading and downloading data. For users who download information at a much greater rate than they upload it (for instance, most domestic users, and businesses using large amounts of information as inputs to their production processes, but transferring relatively small amounts the other way), there are significant time saving advantages in using access methods which download data from the Internet at a much faster rate than data which is uploaded.

While the OECD report states that high-speed access services have been introduced by incumbent operators in just over half of the OECD countries, only thirteen of the twenty-nine countries have fully commercial services operating. Such services are available in Canada, New Zealand and the United States, but in March 2000, high-speed access services in Australia were still listed as being at a "trial" stage[65]. In New Zealand, Telecom's ADSL offering Jetstream is limited to subscribers with suitable copper cable access lines in areas where exchanges are ADSL-capable[66], and Telstra Saturn's Chello and Paradise High Speed offerings are restricted to Wellington and parts of Christchurch, where cables have been laid.

Nonetheless, despite the newness of the technology and the disadvantages of restricted markets, development of high-speed services in New Zealand compares extremely favourably with Canada and the United States. Canada is the price leader in this group of countries, but, similar to the pricing advantage we have already demonstrated with respect to 20 hours per month access for ISP provision via PSTN, New Zealand high-speed access costs are also apparently lower than those in the United States for some volumes of transfer. Although initial connection charges are significantly higher, monthly rental for Telecom's Xtra Velocity (Jetstream) 600 megabyte per month ADSL service is 15% lower than the comparable Bell Atlantic Personal Infospeed service ($43.15 against $49.95 in US dollar purchasing power parity terms)[67]. A similar advantage would be expected for Telstra Saturn's Chello and Paradise High Speed cable modem options, as the per unit price in New Zealand dollars is comparable ($90 for Chello and Paradise High Speed, $99 for Jetstream at 23/8/00 – cable thus 10% cheaper). However, the OECD figures place the Telstra Saturn product at 63% higher than the American equivalent in purchasing power parity terms[68], despite cable having approximately the same price advantage in PPP terms in the United States to that in real dollar terms in New Zealand (14% cheaper). Our analysis leads us to believe that the OECD figures for cable modem services are also wildly distorted by double counting and lack of clarity in the bundle of products offered. Telstra Saturn offers its high-speed cable services in bundles that include telephone connection, modem and cable TV. The OECD figure of $US56.07 for New Zealand cable modem services only become comparable with our observed prices when the full bundle of products is compared – at $NZ134.95, Telstra Saturn's Triple Service, converted at a rate of 0.431 (currency conversion rate at 21/8/00) yields $US58.16. If bundling occurs in other countries, and the extent of the

[65] OECD *Local Access Pricing and E-Commerce* p53.
[66] Only 69 out of Telecom's some 200 exchanges are listed as ADSL-capable – http://www.telecom.co.nz.
[67] OECD *Local Access Pricing and E-Commerce* p69.
[68] OECD *Local Access Pricing and E-Commerce* p71.

bundling differs, then it is difficult if not impossible to accurately compare cable modem prices between countries using the OECD figures[69].

That said, although we cannot confidently comment on comparative cable modem prices with any certainty using the OECD figures, we believe that, on the basis of ADSL prices and New Zealand retail prices of cable modem services, at lower volumes of data transfer New Zealand high-speed access services are the second cheapest in the world, after Canada. This would indicate that even in this emergent technology with limited access, there is sufficient demand, and hence uptake, to suggest that New Zealanders are migrating to new services as they become available at least as rapidly, and possibly more rapidly, than comparable US users.

That the comparative New Zealand advantage over the United States is at the lower end of data exchange quantity lends some support to the hypothesis that, consistent with size and business profile, existing New Zealand demand is driven largely by individual, domestic and smaller business use, rather than medium to larger businesses, where data exchange quantities would be expected to be larger. Such adoption parallels the ease with which these New Zealanders transferred familiarity with banking technologies to familiarity with Internet technologies. However, we must add a caveat here. The advantage at low levels may also be masking a barrier to uptake at higher levels of usage due to the per megabyte metering charges of both Telecom's Jetstream and Telstra Saturn's Paradise High Speed once a predetermined number of megabytes have been downloaded in a given month. Jetstream offers four base levels of downloading (600, 1500, 3000 and 10,000 MB per month) but charges 20c/MB if the chosen limit is exceeded. Paradise allows 500MB per month, but charges 2c/MB for excess downloads from New Zealand sites and 20c/MB for downloads from overseas sites. This compares with services in the United States and Canada, where the monthly charge includes unlimited downloads[70]. It is likely that these metering charges may be restricting smaller organisations from downloading even more data, and pushing back the time at which businesses with higher download needs are choosing to enter the market, especially if the data needs are from foreign suppliers. This charging pattern may be potentially "undoing" many of the advantages New Zealand has gained from having unmetered telephone access, especially if this is a significant

[69] Bundling poses difficulties in deciding how to allocate fixed costs across all of the bundled products. In most cases, the allocation method chosen is arbitrary. Furthermore, the way in which firms report prices often lacks clarity, which could affect the veracity of subsequent analyses – for instance, it is possible that firms with bundled products might report 2 lines as 2 subscribers to third party analysts such as the OECD, thereby contributing to inaccurate reporting.

[70] OECD *Local Access Pricing and E-Commerce* p 69.

cause of lower penetration and less competitive pricing than the US and Canada at high levels of uptake. It will be interesting to monitor how uptake of Chello, Telstra Saturn's newest high speed access service, which includes unlimited monthly downloads in the monthly fee, compares with the existing products, and whether this will cause a change in pricing policies of the other products. The pricing of these "new" products must be continually under review, as has been ISP charges (see Enright (2000)). The (anecdotal) rise in demand for satellite downloading services (such as provided by Ihug) is likely to also be a competitive response to the Jetstream and Paradise pricing policies.

Thus, New Zealanders would appear to be early and avid adopters of new technologies in the areas where demonstrated concrete benefits exist. We would expect that this pattern of uptake will also be evident in adoption of other emergent technologies, such as satellites used for downloading.

Summary

This analysis using Internet penetration and telecommunications infrastructure data not only offers reassurance that New Zealand is truly a world leader already in electronic commerce, but, together with the evidence from the Banking Sector, helps explain how this position has been both achieved and sustained. Ironically, the Kiwi Share policy has facilitated the development of a telecommunications pricing structure that has actually enhanced New Zealand's ability to be an early adopter of electronic commerce. However, this has not been achieved by setting the price of telephone access – rather it has been achieved by enshrining an un-metered pricing structure for local calls! In addition, the New Zealand position has been buttressed by competitive pressure in broadband that has kept the price low by world standards, particularly when New Zealand's population density implies that higher costs compared to more densely populated countries could be expected (see Alger and Leung (1999)).

However, the OECD analysis also comes with a significant caveat. If New Zealand is to both maintain and build upon its current world leadership in electronic commerce uptake, then as long as access to the Internet is governed by the telecommunications industry, the current environment should not be altered unless it is to maintain or improve upon the four key policy areas of which the OECD report argues at least two are required to encourage electronic commerce adoption:

- high level policy support for a range of tariff options, in particular pricing favourable to 'always-on' capabilities necessary to support electronic commerce
- policy support for infrastructure competition
- policy support for unbundling local loops[71]
- policy support for the development of high-speed access options.

New Zealand's current position as an electronic commerce leader has been encouraged by the existence of a telecommunications environment embracing three of these four key elements. Continued electronic commerce development, and maintaining a world-leading position, will be dependent upon enhancing this environment further. Future policy changes in the telecommunications area must take cognisance of this finding – any changes which limit or decrease options in any one of these policy areas will undoubtedly result in restrictions to continued electronic commerce growth[72].

It must also be noted that the policy environment should recognise and account for the fact that telecommunications may not remain the dominant gateway to the Internet. Already we are witnessing the emergence of satellite technology for high volume one-way data transfers. Such technologies will undoubtedly bring new pricing based upon different usage patterns, and change the balance of factors which encourage electronic commerce development.

Thus, it is important that electronic commerce developments be nurtured by the existence of a relevant and conducive policy environment flexible enough to embrace the demands of changing technologies and drivers, rather than by enshrining into regulation prices and strategies based upon the qualities of a limited number of existing technologies.

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[71] Boles de Boer, Enright and Evans ("The Performance of Internet Service Provider (ISP) Markets of Australia and New Zealand: implications for regulatory policy*", Info: the journal of policy regulation and strategy for telecommunications , information and media,* Vol 2, No 5, October 2000, forthcoming.) provide evidence that lower infrastructure competition has resulted from unbundling local loops where access regulation has been the method used to achieve unbundling, rather than the processes of competition. As a result, access regulation has resulted in higher final prices to consumers .

[72] Importantly the OECD urges against taking a "retrograde step that would return policy makers to setting telecommunications tariffs". OECD *Local Access Pricing and E-Commerce.* p5.

Table 6: OECD Telecommunications and ISP Access Charges

Table 6.1. OECD Internet access basket for 20 hours at peak times using discounted PSTN rates, including VAT, 2000

	PSTN fixed charge		PSTN usage charge		ISP charge		Total	
	US$	PPP	US$	PPP	US$	PPP	US$	PPP
Korea	2.42	3.90	10.47	16.88	3.77	6.09	16.66	26.87
Italy	12.43	13.97	12.35	13.88	0.00	0.00	24.78	27.85
Finland	13.22	11.40	11.98	10.33	8.07	6.95	33.27	28.68
Australia	8.55	9.71	1.85	2.10	17.25	19.60	27.65	31.42
United States	14.29	14.29	2.33	2.33	16.45	16.45	33.07	33.07
France	11.64	11.19	0.00	0.00	23.72	22.81	35.36	34.00
Turkey	2.11	3.83	4.39	7.97	12.28	22.33	18.77	34.13
Japan	18.45	10.61	22.71	13.05	19.87	11.42	61.04	35.08
Iceland	7.30	5.57	26.48	20.22	12.32	9.41	46.11	35.20
Canada	17.11	20.61	0.00	0.00	12.63	15.22	29.74	35.83
Sweden	12.07	10.14	27.89	23.44	2.76	2.32	42.72	35.90
Mexico	17.01	23.62	0.00	0.00	8.88	12.34	25.89	35.96
New Zealand	17.73	22.73	0.00	0.00	12.20	15.63	29.92	38.36
Germany	12.42	11.94	18.02	17.32	9.96	9.58	40.39	38.84
Greece	7.95	9.82	8.30	10.24	17.28	21.34	33.53	41.39
Norway	19.17	14.52	25.50	19.32	11.82	8.95	56.49	42.79
Spain	11.55	14.08	26.00	31.71	0.00	0.00	37.55	45.79
Netherlands	15.37	15.84	30.73	31.68	0.00	0.00	46.10	47.53
Denmark	15.81	12.35	46.06	35.99	0.00	0.00	61.88	48.34
Switzerland	15.36	11.72	48.66	37.14	0.00	0.00	64.01	48.86
OECD average	12.62	13.54	21.08	24.04	10.23	12.01	43.93	49.59
United Kingdom	19.12	16.48	43.00	37.07	0.00	0.00	62.12	53.55
Ireland	15.40	16.56	20.62	22.18	15.04	16.17	51.06	54.90
Austria	17.07	16.41	45.24	43.50	0.00	0.00	62.31	59.91
Luxembourg	13.39	13.39	0.00	0.00	48.41	48.41	61.80	61.80
Poland	5.88	10.89	31.77	58.83	0.00	0.00	37.65	69.73
Portugal	12.79	17.53	23.30	31.92	18.93	25.94	55.03	75.39
Belgium	15.85	16.18	58.13	59.31	0.00	0.00	73.98	75.49
Czech Republic	4.82	11.22	30.10	69.99	12.35	28.73	47.27	109.93
Hungary	9.78	22.23	35.55	80.79	12.57	28.58	57.91	131.60

Note: PSTN fixed charges include monthly rental fee and additional monthly charges related to discount plans, if applicable. Includes 20 one-hour calls. In France and Luxembourg, ISP and PSTN usage charges are bundled and included under the ISP.
Source: OECD, http://www.oecd.org/dsti/sti/it/cm/

Table 6.2. OECD Internet access basket for 20 hours at off-peak times using discounted PSTN rates, including VAT, 2000

	PSTN fixed charge		PSTN usage charge		ISP charge		Total	
	US$	PPP	US$	PPP	US$	PPP	US$	PPP
Italy	12.43	13.97	7.55	8.48	0.00	0.00	19.98	22.45
Finland	13.22	11.40	6.42	5.53	8.07	6.95	27.70	23.88
Sweden	12.07	10.14	14.41	12.11	2.76	2.32	29.24	24.57
United Kingdom	14.76	12.72	0.00	0.00	14.60	12.59	29.36	25.31
Iceland	7.30	5.57	13.80	10.53	12.32	9.41	33.42	25.51
Spain	11.55	14.08	9.43	11.50	0.00	0.00	20.98	25.58
Korea	2.42	3.90	10.47	16.88	3.77	6.09	16.66	26.87
Ireland	15.40	16.56	10.23	11.00	0.00	0.00	25.63	27.56
Switzerland	15.36	11.72	21.90	16.71	0.00	0.00	37.25	28.44
Denmark	15.81	12.35	16.10	12.58	5.46	4.27	37.38	29.20
Austria	17.07	16.41	15.36	14.77	0.00	0.00	32.43	31.19
Australia	8.55	9.71	1.85	2.10	17.25	19.60	27.65	31.42
Turkey	2.11	3.83	3.07	5.58	12.28	22.33	17.46	31.74
Netherlands	17.59	18.13	14.21	14.65	0.00	0.00	31.80	32.78
United States	14.29	14.29	2.33	2.33	16.45	16.45	33.07	33.07
France	11.64	11.19	0.00	0.00	23.72	22.81	35.36	34.00
Japan	18.45	10.61	22.71	13.05	19.87	11.42	61.04	35.08
Canada	17.11	20.61	0.00	0.00	12.63	15.22	29.74	35.83
Mexico	17.01	23.62	0.00	0.00	8.88	12.34	25.89	35.96
Norway	19.17	14.52	16.65	12.61	11.82	8.95	47.63	36.09
OECD average	12.55	13.49	10.35	11.97	9.39	10.67	32.29	36.14
New Zealand	17.73	22.73	0.00	0.00	12.20	15.63	29.92	38.36
Belgium	15.85	16.18	21.84	22.28	0.00	0.00	37.69	38.46
Germany	12.42	11.94	18.02	17.32	9.96	9.58	40.39	38.84
Luxembourg	13.39	13.39	0.00	0.00	26.57	26.57	39.96	39.96
Greece	7.95	9.82	8.30	10.24	17.28	21.34	33.53	41.39
Czech Republic	4.82	11.22	13.60	31.62	4.77	11.10	23.19	53.94
Portugal	12.79	17.53	10.49	14.37	18.93	25.94	42.22	57.83
Poland	5.88	10.89	31.77	58.83	0.00	0.00	37.65	69.73
Hungary	9.78	22.23	9.72	22.08	12.57	28.58	32.07	72.89

Note: PSTN fixed charges include monthly rental fee and additional monthly charges related to discount plans, if applicable.
The basket includes 20 one-hour calls. Off peak is taken at 20:00.
In France and Luxembourg, ISP and PSTN usage charges are bundled and included under the ISP charge.
Source: OECD, http://www.oecd.org/dsti/sti/it/cm/

Table 6.3. OECD Internet access basket for 30 hours at peak times using discounted PSTN rates, including VAT, 2000

	PSTN fixed charge		PSTN usage charge		ISP charge		Total	
	US$	PPP	US$	PPP	US$	PPP	US$	PPP
Finland	13.22	11.40	17.98	15.50	8.07	6.95	39.26	33.84
France	11.64	11.19	0.00	0.00	23.72	22.81	35.36	34.00
United States	14.29	14.29	3.50	3.50	16.45	16.45	34.23	34.23
Italy	12.43	13.97	18.52	20.81	0.00	0.00	30.96	34.79
Korea	2.42	3.90	15.70	25.32	3.77	6.09	21.89	35.31
Canada	17.11	20.61	0.00	0.00	12.63	15.22	29.74	35.83
Mexico	17.01	23.62	0.00	0.00	8.88	12.34	25.89	35.96
Australia	8.55	9.71	2.78	3.16	21.60	24.55	32.92	37.41
Turkey	2.11	3.83	6.58	11.96	12.28	22.33	20.96	38.12
Japan	18.45	10.61	34.07	19.58	21.77	12.51	74.29	42.70
New Zealand	17.73	22.73	0.00	0.00	17.07	21.89	34.80	44.61
Iceland	7.30	5.57	39.72	30.32	12.32	9.41	59.35	45.30
Greece	7.95	9.82	12.44	15.36	17.28	21.34	37.68	46.52
Germany	12.42	11.94	27.02	25.98	9.96	9.58	49.40	47.50
Sweden	12.07	10.14	41.84	35.16	2.76	2.32	56.67	47.62
Norway	19.17	14.52	37.71	28.57	11.82	8.95	68.70	52.05
Spain	11.55	14.08	38.95	47.51	0.00	0.00	50.50	61.58
OECD average	13.63	15.84	30.27	32.94	11.63	13.78	55.53	62.57
Netherlands	15.37	15.84	46.10	47.53	0.00	0.00	61.47	63.37
Ireland	15.40	16.56	30.94	33.26	15.04	16.17	61.37	65.99
Denmark	15.81	12.35	69.09	53.98	0.00	0.00	84.91	66.33
Switzerland	15.36	11.72	72.98	55.71	0.00	0.00	88.34	67.44
United Kingdom	19.12	16.48	65.94	56.84	0.00	0.00	85.06	73.32
Austria	17.07	16.41	67.86	65.25	0.00	0.00	84.93	81.66
Luxembourg	13.39	13.39	0.00	0.00	70.24	70.24	83.64	83.64
Portugal	12.79	17.53	34.96	47.89	18.93	25.94	66.69	91.35
Poland	5.88	10.89	47.65	88.25	0.00	0.00	53.54	99.14
Belgium	15.85	16.18	87.19	88.97	0.00	0.00	103.05	105.15
Czech Republic	4.82	11.22	45.14	104.98	12.35	28.73	62.32	144.93
Hungary	39.12	88.91	13.20	30.01	20.19	45.90	72.52	164.81

Note: PSTN fixed charges include monthly rental fee and additional monthly charges related to discount plans, if applicable. Includes 30 one-hour calls. In France and Luxembourg, ISP and PSTN usage charges are bundled and included under the ISP

Source: OECD, http://www.oecd.org/dsti/sti/it/cm/

Table 6.4. OECD Internet access basket for 30 hours at off-peak times using discounted PSTN rates, including VAT, 2000

	PSTN fixed charge		PSTN usage charge		ISP charge		Total	
	US$	PPP	US$	PPP	US$	PPP	US$	PPP
United Kingdom	14.76	12.72	0.00	0.00	14.60	12.59	29.36	25.31
Finland	13.22	11.40	9.63	8.30	8.07	6.95	30.91	26.65
Italy	12.43	13.97	11.32	12.72	0.00	0.00	23.75	26.69
Sweden	12.07	10.14	21.61	18.16	2.76	2.32	36.44	30.62
Iceland	7.30	5.57	20.70	15.80	12.32	9.41	40.32	30.78
Spain	11.55	14.08	14.13	17.24	0.00	0.00	25.68	31.32
Ireland	15.40	16.56	15.35	16.50	0.00	0.00	30.74	33.06
France	11.64	11.19	0.00	0.00	23.72	22.81	35.36	34.00
United States	14.29	14.29	3.50	3.50	16.45	16.45	34.23	34.23
Turkey	2.11	3.83	4.61	8.37	12.28	22.33	18.99	34.53
Korea	2.42	3.90	15.70	25.32	3.77	6.09	21.89	35.31
Denmark	15.81	12.35	24.15	18.87	5.46	4.27	45.43	35.49
Canada	17.11	20.61	0.00	0.00	12.63	15.22	29.74	35.83
Mexico	17.01	23.62	0.00	0.00	8.88	12.34	25.89	35.96
Switzerland	15.36	11.72	32.84	25.07	0.00	0.00	48.20	36.79
Australia	8.55	9.71	2.78	3.16	21.60	24.55	32.92	37.41
Austria	17.07	16.41	23.05	22.16	0.00	0.00	40.12	38.57
Netherlands	17.59	18.13	21.32	21.98	0.00	0.00	38.91	40.11
Norway	19.17	14.52	24.81	18.80	11.82	8.95	55.80	42.27
Japan	18.45	10.61	34.07	19.58	21.77	12.51	74.29	42.70
OECD average	12.55	13.49	15.47	17.88	10.41	12.07	38.42	43.44
New Zealand	17.73	22.73	0.00	0.00	17.07	21.89	34.80	44.61
Greece	7.95	9.82	12.44	15.36	17.28	21.34	37.68	46.52
Germany	12.42	11.94	27.02	25.98	9.96	9.58	49.40	47.50
Belgium	15.85	16.18	32.75	33.42	0.00	0.00	48.61	49.60
Luxembourg	13.39	13.39	0.00	0.00	37.49	37.49	50.88	50.88
Portugal	12.79	17.53	14.16	19.39	18.93	25.94	45.89	62.86
Czech Republic	4.82	11.22	20.39	47.43	4.77	11.10	29.99	69.75
Poland	5.88	10.89	47.65	88.25	0.00	0.00	53.54	99.14
Hungary	9.78	22.23	14.57	33.12	20.19	45.90	44.55	101.25

Note: PSTN fixed charges include monthly rental fee and additional monthly charges related to discount plans, if applicable. The basket includes 30 one-hour calls. Off peak is taken at 20:00.
In France and Luxembourg, ISP and PSTN usage charges are bundled and included under the ISP charge.
Source: OECD, http://www.oecd.org/dsti/sti/it/cm/

Table 6.5. OECD Internet access basket for 40 hours at peak times using discounted PSTN rates, including VAT, 2000

	PSTN fixed charge		PSTN usage charge		ISP charge		Total	
	US$	PPP	US$	PPP	US$	PPP	US$	PPP
United States	14.29	14.29	4.66	4.66	16.45	16.45	35.40	35.40
Canada	17.11	20.61	0.00	0.00	12.63	15.22	29.74	35.83
Mexico	17.01	23.62	0.00	0.00	8.88	12.34	25.89	35.96
Australia	8.55	9.71	3.70	4.21	21.60	24.55	33.85	38.47
Finland	13.22	11.40	23.97	20.66	8.07	6.95	45.25	39.01
Italy	12.43	13.97	24.70	27.75	0.00	0.00	37.13	41.72
Turkey	2.11	3.83	8.77	15.95	12.28	22.33	23.16	42.10
Korea	2.42	3.90	20.93	33.76	3.77	6.09	27.13	43.75
New Zealand	17.73	22.73	0.00	0.00	17.07	21.89	34.80	44.61
Japan	18.45	10.61	45.43	26.11	21.77	12.51	85.65	49.22
Greece	7.95	9.82	16.59	20.48	17.28	21.34	41.83	51.64
Iceland	7.30	5.57	52.96	40.43	12.32	9.41	72.59	55.41
Germany	12.42	11.94	36.03	34.64	9.96	9.58	58.41	56.16
Sweden	12.07	10.14	55.79	46.88	2.76	2.32	70.62	59.34
France	11.64	11.19	0.00	0.00	50.58	48.64	62.22	59.83
Norway	19.17	14.52	49.56	37.55	11.82	8.95	80.55	61.02
OECD average	13.63	15.84	40.37	43.93	14.00	16.63	68.00	76.41
Ireland	15.40	16.56	41.25	44.35	15.04	16.17	71.68	77.08
Spain	11.55	14.08	51.91	63.30	0.00	0.00	63.45	77.38
Netherlands	15.37	15.84	61.47	63.37	0.00	0.00	76.83	79.21
Denmark	15.81	12.35	92.12	71.97	0.00	0.00	107.94	84.33
Switzerland	15.36	11.72	97.31	74.28	0.00	0.00	112.67	86.01
United Kingdom	19.12	16.48	88.88	76.62	0.00	0.00	107.99	93.10
Austria	17.07	16.41	90.48	87.00	0.00	0.00	107.55	103.41
Luxembourg	13.39	13.39	0.00	0.00	92.08	92.08	105.47	105.47
Portugal	12.79	17.53	46.61	63.85	30.59	41.90	89.99	123.28
Poland	5.88	10.89	63.54	117.66	0.00	0.00	69.42	128.56
Belgium	15.85	16.18	116.26	118.63	0.00	0.00	132.11	134.81
Czech Republic	4.82	11.22	60.19	139.98	12.35	28.73	77.37	179.92
Hungary	39.12	88.91	17.60	40.01	28.58	64.95	85.30	193.86

Note: PSTN fixed charges include monthly rental fee and additional monthly charges related to discount plans, if applicable. Includes 40 one-hour calls. In France and Luxembourg, ISP and PSTN usage charges are bundled and included under the ISP.
Source: OECD, http://www.oecd.org/dsti/sti/it/cm/

Table 6.6. OECD Internet access basket for 40 hours at off-peak times using discounted PSTN rates, including VAT, 2000

	PSTN fixed charge		PSTN usage charge		ISP charge		Total	
	US$	PPP	US$	PPP	US$	PPP	US$	PPP
United Kingdom	14.76	12.72	0.00	0.00	14.60	12.59	29.36	25.31
Finland	13.22	11.40	12.84	11.07	8.07	6.95	34.12	29.42
Italy	12.43	13.97	15.09	16.96	0.00	0.00	27.53	30.93
United States	14.29	14.29	4.66	4.66	16.45	16.45	35.40	35.40
Canada	17.11	20.61	0.00	0.00	12.63	15.22	29.74	35.83
Mexico	17.01	23.62	0.00	0.00	8.88	12.34	25.89	35.96
Iceland	7.30	5.57	27.60	21.07	12.32	9.41	47.22	36.05
Sweden	12.07	10.14	28.81	24.21	2.76	2.32	43.64	36.68
Spain	11.55	14.08	18.83	22.97	0.00	0.00	30.38	37.05
Turkey	2.11	3.83	6.14	11.16	12.28	22.33	20.53	37.32
Australia	8.55	9.71	3.70	4.21	21.60	24.55	33.85	38.47
Ireland	15.40	16.56	20.46	22.00	0.00	0.00	35.86	38.56
Denmark	15.81	12.35	32.20	25.15	5.46	4.27	53.48	41.78
Korea	2.42	3.90	20.93	33.76	3.77	6.09	27.13	43.75
New Zealand	17.73	22.73	0.00	0.00	17.07	21.89	34.80	44.61
Switzerland	15.36	11.72	43.79	33.43	0.00	0.00	59.15	45.15
Austria	17.07	16.41	30.73	29.55	0.00	0.00	47.80	45.96
Netherlands	17.59	18.13	28.42	29.30	0.00	0.00	46.01	47.43
Norway	19.17	14.52	32.79	24.84	11.82	8.95	63.78	48.31
Japan	18.45	10.61	45.43	26.11	21.77	12.51	85.65	49.22
OECD average	12.55	13.49	20.61	23.83	12.18	14.24	45.34	51.56
Greece	7.95	9.82	16.59	20.48	17.28	21.34	41.83	51.64
Germany	12.42	11.94	36.03	34.64	9.96	9.58	58.41	56.16
France	11.64	11.19	0.00	0.00	50.58	48.64	62.22	59.83
Belgium	15.85	16.18	43.67	44.56	0.00	0.00	59.53	60.74
Luxembourg	13.39	13.39	0.00	0.00	48.41	48.41	61.80	61.80
Portugal	12.79	17.53	18.88	25.86	24.18	33.12	55.85	76.51
Czech Republic	4.82	11.22	27.19	63.24	4.77	11.10	36.79	85.56
Poland	5.88	10.89	63.54	117.66	0.00	0.00	69.42	128.56
Hungary	9.78	22.23	19.43	44.16	28.58	64.95	57.79	131.34

Note: PSTN fixed charges include monthly rental fee and additional monthly charges related to discount plans, if applicable. The basket includes 40 one-hour calls. Off peak is taken at 20:00.
In France and Luxembourg, ISP and PSTN usage charges are bundled and included under the ISP charge.
Source: OECD, http://www.oecd.org/dsti/sti/it/cm/

Table 7: Examples of New Zealand Internet & Telephony Package Prices (as at 23/8/00)

Table 7.1: ISP Access via PSTN

	Telecom/Xtra	**Telstra Saturn/Paradise**
Line Rental – 1 line	$36.34	$29.95
Cost of additional line (% of base)	$29.95 (82%)	N/a
1 line + 20 hours/month Internet	$61.34 (NZ Plan)	$39.95 (Net Starter)
2 lines + 20 hours/month Internet	$91.29 (NZ Plan)	$58.95 (Net Surfer)
Cost of additional line (% of base)	$29.95 (82%)	$19.00 (63%)
1 lines + 250 hours/month Internet	$61.29 (Value Pack)	$47.35 (Net Starter)
2 lines + 250 hours/month Internet	$91.24 (Value Pack)	$69.75 (Net Surfer)
Cost of additional line (%of base)	$29.95 (82%)	$22.40 (75%)

It is also noted that Telstra Saturn also has price discounts relating to cable television supply which also effectively discount Internet access with respect to this means of connectivity.

Table 7.2 High-Speed Access via ADSL and Cable Modems

Telecom Jetstream (ADSL)					
Megabytes/Month	600	1500	3000	5000	10000
Monthly Rental	$99.00	$229.00	$379.00	$579.00	$1029.00

Saturn Telstra (Cable Modems)			
Package	**Contains**	**Chello**	**Paradise**
Telephone	Telephone High speed modem	109.95	109.95
Cable	High speed modem Cable TV	$109.95	$109.95
Net Surfer	Telephone Second line High speed modem	$134.95	$134.95
Triple Service	Telephone High speed modem Cable TV	$134.95	$134.95
The Big Deal	Telephone Second line High speed modem Cable TV	$149.95	$149.95
Note that Chello offers unlimited monthly downloads, Paradise High Speed includes 500Mb per month. Extra Mb charges 2c/Mb National, 20c/Mb International.			

Uptake and Usage - Firm-level Analysis

Our analysis leads to the conclusion that, from a consumer perspective, New Zealand is both well-placed to take advantage of the opportunities of electronic commerce and already active in this area. The significant finding of our analysis is that this position has, by most of the measures we have examined, been achieved largely as a result of significant consumer demand for services. When businesses have chosen to become engaged in electronic commerce, this is because of a mutual meeting of customer requirements and business willingness to provide the services these customers want, in the most efficient manner. The most technically effective electronic delivery mechanism will not develop into a commercially successful business venture unless there is firstly a willingness for consumers to purchase the product and a balance between costs and benefits for the producer to enable him to offer the product at a price which the consumer is prepared to pay. In New Zealand, we have witnessed such mutual meetings in the application of EFTPOS, uptake of ISP services and, apparently, uptake of high-speed access services.

Yet, while the infrastructure appears to be in place, and we see considerable evidence of vibrant electronic commerce activity at the consumer, retail and small business end of the spectrum, lack of clarity and consequent debate still exists about both the size and type of businesses utilising the infrastructure, and the types of electronic commerce activities in which they are engaged. Furthermore, there is also much debate about the comparative abilities of New Zealand businesses to themselves develop new and innovative ways of applying technologies and infrastructures to commercial activities.

Which Firms are Participating?

At the time of writing, no publicly published studies of New Zealand business use of electronic commerce applications exit. However, the Ministry of Economic Development is in the process of undertaking a business-based survey of electronic commerce applications, and the Institute for the Study of Competition and Regulation is analysing New Zealand email and website addresses by region and business classification. The outcomes of these studies will go a considerable way towards answering the questions of which businesses are participating, in what activities they engage, and the extent of differences between the activities of businesses based upon size, sector and location. Nevertheless, some trends are already evident.

Public versus Private

While most departments and trading entities at the central government level have websites and utilise email extensively, as yet, applications such as the those of the Companies Office for registration of companies, and Land Information New Zealand for the land registry notwithstanding, there has not been extensive use of the Internet infrastructure for interactive trading. However, development of an E-Government strategy has begun, with an initial target of 2005 as the date by which all government transaction activities will be electronic[73]. It is noted that this target is some four years later than the Australian government's target of 2001[74] for total electronic government transacting. Thus we conclude that New Zealand's demonstrated Internet infrastructure advantage over Australia would appear to be as a result of greater private sector uptake and usage rather than public sector initiative.

Large versus Medium versus Small

Significant difficulties exist in using infrastructure figures to determine the size of businesses participating in electronic commerce. While counts of user numbers yield an indication of the spread of uptake among businesses, they do not give any information about the value of business conducted electronically. For instance, a small business such as ISCR has the same number of domain names registered as a large institution such as Victoria University, despite the latter being a significantly greater source of transactions.

However, despite the lack of statistics, our analysis appears to indicate that, particularly as a result of the ubiquity of EFTPOS amongst retailers and the apparent cost advantages for ISPs over low levels of data transfer, smaller businesses and individuals figure prominently by volume in day-to-day usage of electronic commerce activities. It is acknowledged that large businesses such as Telecom and Fletcher Challenge maintain proprietary electronic networks for their daily business activities, which fall within the definition of electronic commerce but not in Internet infrastructure figures. Nonetheless, it appears from the available information that there may be a lesser degree of uptake of Internet-based applications by medium-sized and large businesses.

[73] MED E-Government Strategy. http://med.govt.nz.
[74] NOIE (1998) *Electronic Commerce Strategy*.

This is supported to some extent by anecdotal evidence and studies such as ITAG (1999) and Ernst and Young (1999)), but we caution that the position should not be assumed.

Geography

Although there has been reported widespread concern that rural areas are placed at a disadvantage in electronic commerce participation as a consequence of lower levels of, particularly, telecommunications infrastructure[75], currently available statistics paint a more equivocal picture. Despite infrastructure disadvantages such as extensive use of low capacity copper cable, low maintenance levels and physical distance from cellphone towers, Atkins (2000) demonstrates that telephone and mobile phone penetration in rural areas (99% and 70% respectively) exceed the national averages (96% and 40%). Furthermore, this survey shows computer usage in rural areas (61%) at least matches if not exceeds the national penetration (42.8% at 1998, approximately 50% in 2000 by current MED projections), with 76% of those computers being used for business purposes, and 81% connected to the Internet. Anecdotal evidence also supports the contention that EFTPOS is also widespread in rural communities (for example, by verbal report, four EFTPOS terminal locations in Haast, three in Te Araroa).

Thus we conclude that, while lower levels of telecommunications infrastructure in rural areas may be compromising the types of transaction activity undertaken[76], this does not appear at the current point in time to be suppressing development and uptake of electronic commerce in rural areas. Indeed, geographic isolation may be adding a greater incentive to become connected to, especially, the Internet. This is demonstrated by the willingness of rural users to substitute new technologies for the telephony technology which is causing apparent bottlenecks: 17% of respondents to Atkins' survey have a satellite dish for digital data downloading (both television signals and other data), and he reports significant interest in early adoption of wireless applications.

Technologies are now in place supporting mobile telephony EFTPOS terminals[77], further extending the geographic coverage of such commercial applications into rural and remote areas.

[75] See, for example, Atkins (2000) and ITAG 1999.

[76] Kiwi Dairy has stated that the company's website design had to be simple, with limited graphics, to overcome the difficulties of downloading complicated digital images over the low grade copper cables servicing many of their farmers – Edlin, Bob. *Poor State of Rural Telecommunications Threaten Growth*, Rural News September 4, 2000 p 22.

[77] Vodafone announced the commercial release of a mobile EFTPOS terminal in the week beginning 4/9/00.

This also reinforces the change of focus of electronic trading that we have witnessed away from physical business units and fixed locations towards individual transactors, wherever they may be. Indeed, we postulate that the pattern of uptake that we are seeing in rural areas merely reinforces the potential advantage New Zealand has in making the cultural and social transition to a "modern economy" where transactors are all individual and mobile, and thus "remote" from physical centres of infrastructure management.

Furthermore, the pattern of rural uptake may also be mirroring the relative advantages for New Zealand in that physical isolation raises the relative benefits of electronic commerce for the country compared to the rest of the world, just as physical isolation raises the relative benefits of electronic commerce for rural users compared to their urban counterparts. The incentives for such geographically-isolated users to become "connected" are greater, so the point where benefits exceed costs is reached earlier, with consequently higher uptake figures witnessed in these areas when geographic comparisons are undertaken.

What are they Using it For?

Infrastructure analysis, while still a much less than perfect proxy, does offer some insights into the type of electronic commerce applications that Internet connectivity, in particular, is used for. We have already discussed the role that secure servers play in measuring secure data, and hence business, transfer needs. While we have offered some possible explanations for New Zealand's anomalous figure compared with Australia, we must not lose sight of the fact that New Zealand is still fourth in the world in secure servers per head of population. This, of itself, underlines the fact that there must be significant use of Internet infrastructures for commercial endeavour.

On both an industry and firm basis, we can cite a number of successful electronic commerce applications embracing a wide range of services. The New Zealand wholesale electricity market was the first physical electricity market in the world to be traded over the Internet[78]. This application, without which the wholesale electricity market could not operate, won the 2000 Computerworld Excellence Award for Internet Commerce, and by 1998 figures accounted for

[78] Only recently has it been joined by the PJM pool in the north east of the United States.

over 1% of international business to business e-commerce[79]. Other applications include Trade Me, with 20,000 online auction sales in the past 18 months[80], and Mainfreight, which has developed "informational visibility" products to complement their traditional business of moving freight[81]. Aoraki and McVicars' online trading exchange for the timber industry, Lignus, is poised to become the dominant industry exchange for the Pacific rim[82], and Clear is establishing Trading Point, a procurement system aimed at the top 500 New Zealand corporates[83].

Furthermore, we postulate that there may be a number of valid reasons why many New Zealand firms have opted not to engage in electronic commerce activities at the present point in time.

Optimal Time to Invest

Firstly, it is possible that, due to the small size of New Zealand, and the relatively small scale of businesses (relative to the world), for many businesses, given the types of transactions they undertake, and the markets in which they offer their services, the most efficient way of transacting is still by non-electronic methods. Indeed, if such businesses were to adopt electronic methods without cost/benefit-related justifications, then the overall economic effect would be a decline in productivity due to misused resources. It may just be that for many businesses, the optimal time to invest has not yet been reached.

The Nature of the Economy - Economies of Scale

Secondly, due to the open nature of the New Zealand economy, and the greater focus on importing and exporting, it may be that the most efficient way of enabling electronic commerce within some firms is to look offshore, and "piggy back" off the services and applications provided by trading partners with larger scale economies who can offer such services more efficiently. Tools such as the Internet make offshore systems as readily available as those on-shore, so it makes sense to utilise scale economies achievable where possible. Such behaviour is further reinforced by the fact that many of our larger companies belong to foreign-based alliances of various forms, making a broad range of potentially synergetic systems available internally.

The Network Effect

A third reason may be that the largest single transactor in the New Zealand economy, the Government, which manages spending to the extent of 35% of GDP, has not yet become a

[79] A recent Economist magazine put 1998 B2B e-commerce at a total of US$43 billion. In that year, COMIT traded over US$0.5 billion, meaning that this single market accounted for over 1% of international B2B e-commerce.
[80] Infotech, 4/9/00.
[81] As reported by the Ministry of Economic Development.
[82] Southern Skies, September 2000 p 44.

major participant in electronic commerce. Although an E-Government strategy is in the process of being developed, the targets set for a totally electronic government will not be reached until 2005[84]. Limited involvement by such a large transactor dampens the flow-on benefits derived from the network effect of more participants[85].

The Changing Nature of the Firm

Fourthly, the apparent absence of extensive medium to large business presence in New Zealand Internet participation statistics may be a reflection of the fact that New Zealand firms, being small on average by world standards (95% of firms have 10 or fewer employees) have already progressed along the path predicted by Drucker[86] and others towards becoming "information-age" organisations. These Organisation Theorists predict that increased availability of information and reductions in transaction costs will result in much smaller firms (even to the point of individuals being "firms"), project-based work patterns, and an increasingly blurred line between the roles of individuals as producers and consumers. Thus the dominance of New Zealand electronic commerce by individuals and smaller firms may be interpreted as evidence that not only is electronic commerce uptake high, but that the organisational structures best equipped to operate in an "information-age" economy are developing strongly.

There is also a problem for many firms in developing internal systems and controls to the point where decentralised purchasing patterns can be dealt with electronically. For large firms, there may need to be considerable investment in internal systems or restructuring in order to move down the path of electronic commerce. For many firms, these costs may outweigh the benefits at the current point in time[87].

The Role of Information Content– we speculate another dimension?

However, we speculate that there may also be another characteristic by which we can distinguish the comparative extent of firms' electronic commerce participation – the way in which firms use information. While all firms use information to some extent in the course of

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[83] Southern Skies, September 2000 p 48.

[84] Ministry of Economic Development. 1999. *Electronic Government. Briefing to the Minister of State Services and Minister of Information Technology*. Wellington.
http://www.ssc.govt.nz/Documents/Government_Information_and_Technology_Management.htm

[85] Where networks exist, the benefits of additional connectivity rise in proportion to the square of the number of nodes (Metcalf's law).

[86] Drucker, Peter. 1999. *Management challenges for the 21st Century.* New York: Harper Business.

[87] For instance, the entire company structure of Oracle was "re-engineered" to facilitate electronic commerce activity.

transacting their business (for instance, information to monitor the performance of specific activities), some firms have additional information requirements in that their inputs to production and/or finished products are also information products. While all firms can benefit to some extent from reduced transaction costs due to cheaper or more available information via the Internet, even greater advantages exist for firms which can either adapt their products for exchange via electronic trading, or develop electronic co-products to their existing non-electronic outputs. Thus, we would expect to see a greater participation in electronic trading from two specific types of firms: those trading in electronic products or products which can be substituted or complemented by electronic products, and those with very high information needs with respect to their transaction activities.

Electronic commerce hinges on the desire to transfer information. Where the desire for information is high, or the input and output products are information, then we would expect to see higher uptake of electronic commerce. In the case of banking and retail, a "cashless" transaction requires the total substitution of information for cash. Instead of notes and coins being passed from purchaser to seller, information passes from the purchaser into the "system" to instruct a movement of value from his bank account to that of the vendor. Information in this case is a perfect substitute for notes and coins. As we have demonstrated earlier, if the individual benefit to both parties of the electronic trade in information exceeds the individual cost of handling cash, then both the purchaser will demand it and the vendor will provide it. The optimal time to invest will have been determined. Again, in the development of the high-speed data exchange market, it is the consumer's need for large amounts of information transfer that is driving demand. If the benefit value of time saved by faster access methods exceeds the additional cost to the consumer, then a market will develop. However, the consumer must either need, or value highly, the information transferred in the first place.

If there is a low need for information, then irrespective of the relative pricing of access methods, the market will not develop, as there is little need for information to be transferred, given that the potential savings from electronic exchange of information will be low. If this analysis is accurate, then three questions are raised:

- are New Zealand's existing predominant commercial activities in the medium to large business sectors, and non-retail small business sectors, good candidates for transaction cost savings from more effective information transfer?
- do their business activities actually require or produce large amounts of information? and

- can the products created be adapted to information products, or enhanced by the development of electronic co-products?

Information can never substitute for some inputs to production, such as raw materials[88]. However, the growing ability of electronic means to substitute information and information goods for otherwise-physical products is spurring new industries, where the product becomes interchangeable electronically. Some New Zealand content-based industries are taking advantage of electronic commerce to sell products previously sold in tangible form – e.g. the Dunedin digital imaging cluster, and the Wellington-based film industry have replaced film and paper-based images with digital ones, conducive to electronic distribution. By turning the content into "information", the business case for transacting electronically is further substantiated, as the "information value" of the product has increased. However, if the information component of business content is small relative to other components, then it will be less easy to justify electronic methods of transacting. If the nature of New Zealand businesses dictates that they have a lower need for information, or that they create products that cannot of themselves be traded electronically or enhanced by the creation of electronic co-products, then the cost of electronic methods will have to be relatively cheaper to substantiate adoption, and lower uptake would be expected. However, as with the entire area of electronic information exchange and enhancement, it is almost impossible to pick future developments with any surety.

The Nature of the Firm and Electronic Commerce Uptake

While the information content requirements of firms may be significant determinants of electronic commerce uptake, the ability of the firm to utilise information effectively once it has been acquired is also a factor which potentially influences the dominant position of small firms in the observed statistics. Smaller, flatter, less hierarchical firms, such as the profile of some 95% of New Zealand firms, have distinct and demonstrated advantages in decision-making processes, due to the fewer numbers involved in the process. The decision-making process will be more straightforward, and we would expect a quicker uptake process than where there are many

[88] The savings are high for the corner grocery store in exchanging cash handling for EFTPOS, as cash handling is the predominant activity in such a business. Furthermore, the information value of stock management is important in preventing the real costs of lost sales and over-investment in inventory. However, the same level of savings from information transfer is not such a factor for, say, the local plumber, whose cash-handling needs are minimal, and whose other information needs from remote sites are much less. Thus, the retailer is more likely to have a positive benefit-cost justification for electronic commerce tools than the plumber, as the relative value of potentially transferable information is much higher.

decision-makers[89]. Hence, we would expect that the uptake of information products would occur sooner in small firms and those based upon individuals, merely because of the more precise way in which the costs and benefits can be assessed. In the case of large, and particularly risk-averse, organisations, it is much less likely that a timely investment decision can be made, due to the need to get agreement of multiple decisionmakers[90].

Our Analysis

We contend that elements of all of these content-related scenarios are combining in New Zealand, and contributing along with access pricing to the end result that we are witnessing: a much higher uptake of internet access and electronic trading by individuals and smaller traders. We speculate that those larger organisations which have become involved in electronic commerce have done so because there is either a much higher component of information in the "product" that they are creating – for example, banks -, or that they have been able to adapt existing products or create new ones which utilise electronic distribution. For the balance of larger companies producing goods containing elements of information but which are not *per se* information products, cost savings may be gained from exchanges of information about the production of these goods, but the potential for savings is lower than in (say) New Zealand's emergent digital imaging industry, where not only do the processes benefit from information transfer, but the sale of the end product is also an information transfer. Such companies are less likely, we contend, to be represented in the electronic commerce uptake indicators.

Available evidence tends to confirm this analysis. Overseas studies suggest that lower barriers to entry in information-based production have favoured the development of small firms to create new information-based products, rather than encouraging the adaptation of existing firms to meet these needs[91]. The OECD research indicates that New Zealand web sites contain high levels of audio and video content compared to those in the rest of the world, suggesting that many of the businesses utilising the Internet are doing so not just as a means of translating paper-based trading methods into selling online, but to actually exchange information products[92]. This appears to be reinforced by strong levels of high speed access uptake at low levels of usage –

[89] This is inferred from the findings of Jensen and Meckling (1976) where the transaction costs of decisionmaking increase proportionately to the number of persons involved in the process.
[90] Brynjolfsson, Erik. 1994. Information Assets, Technology and Organisation. *Management Science* 40(12): 1645-1662.
[91] US Department of Commerce *Digital Economy 2000* p 16.
[92] OECD *Local Access Pricing and E-Commerce*. p 19

the parties trading information products via the Internet are generally speaking, individuals and small businesses, and there is evidence to suggest that an amount in excess of the international average of this information content is being generated in New Zealand.

Summary

Thus, while we can celebrate the apparent successes of New Zealand preparedness for electronic commerce uptake, it is dangerous to measure this success merely by counting those who are "doing it" without some analysis of the information components of products they are trading in and the reliance upon information of the processes that create them. It would also be dangerous to provide incentives to encourage participation by organisations for whom information is less crucial to engage in electronic trading before the business case of a benefit cost trade-off justifies it. New Zealanders appear to be strongly placed to benefit from the ability to participate as consumers. But questions still remain about the extent to which New Zealand firms are participating as producers. We are as yet uncertain about the significance of this, given the increased blurring between the roles of consumer and producer in an evolving information-based economy. Lack of statistical information precludes us from making an unequivocal assessment at this time[93]. However, anecdotal evidence, combined with reports such as that of ITAG (1999) suggests that New Zealand may still have some way to go in adapting to producing information products for the international market.

Future long term development of New Zealanders as electronic commerce producers as well as electronic consumers rests not just in reducing the transaction costs of market participation, but in developing new information products, and new ways of substituting information products for existing tangible goods. Content is the key.

[93] It is noted that a survey is currently being prepared by the Ministry of Economic Development to address the uses made of electronic commerce within New Zealand businesses.

Policy Implications: Where to From Here?

While New Zealand has demonstrated an internationally high level of infrastructure uptake of technologies, systems and products developed offshore, nonetheless, fears still exist that New Zealand firms may not be as well placed to themselves develop new products and applications based upon electronic trading. That is, doubts exist as to how well can New Zealand to build upon the infrastructure base of Figure 1 and develop applications in the top three segments.

Concerns about the ability to develop new applications are supported by studies such as ITAG and Stern, Porter and Furman[94], which suggest that low levels of research and development expenditure[95], shortage of venture capital, lack of skilled technical, scientific and business graduates and an education system focused on skills other than those required for technological development have resulted in an internationally low innovative capacity. Indeed, by the measures used in the Stern, Porter and Furman study, New Zealand has one of the lowest "national innovative capacities" in the OECD – occupying a position similar to that of Italy and Spain, but less than that of Australia and significantly less than the leaders, the United States and Switzerland. This appears to be driven by a low number of patents registered, low knowledge and intellectual capital stocks and an apparent absence of downstream commercialisation and diffusion of patented applications developed both onshore and overseas. Stern, Porter and Furman further contend that a national innovative environment is influenced by aggregate policy choices such as the extent of intellectual property protection and openness to international trade, the share of research performed by the academic sector, and the relative proportions of research funding from public and private sectors. Spillover effects from the presence of clusters of related industries also play a large role.

Fears that New Zealand may not be as well placed as possible appear to have some foundation, as evidenced by other research undertaken by the authors for the Ministry of Economic Development[96]. Current high levels of uptake have been encouraged by a conducive

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[94] Stern, Scott; Michael Porter and Jeffrey Furman. 2000. *The Determinants of National Innovative Capacity.* National Bureau of Economic Research Working Paper 7876.

[95] Data for international comparisons such as this study must be scrutinised carefully. There is, for example, controversey about the extent to which other countries' tax-deductibility provisions for research and development accentuate their reported research and development expenditure relative to New Zealand's neutral business tax system: the induced disparity in reporting may be large.

[96] ISCR. 2000. *Scoping Report: Towards a "Modern Economy" E-Commerce Strategy for New Zealand. Wellington: NZ ISCR.*

telecommunications, banking and trade policy environment. This environment has supported an extensive "early adopter" culture which, while the technological developments may not have been locally invented, have been quickly implemented here. Furthermore, where local innovation has occurred, it has been suggested that this may have been to some extent associated with "clustered" industries such as agriculture and digital imaging[97]. However, downward trends in the level of knowledge stocks, with significant emigration of skilled personnel in the scientific, technical and managerial sectors[98], apparently flat and low levels of patent registration in an international environment[99] where patent-registering activity is increasing, and uncertainty in policy treatments of research and development activities raise signficant causes for concern[100].

In the absence of any firm-specific information about the level of innovation and future electronic commerce activity adoption, we cannot counter the claims that these studies make about New Zealand's national performance as an innovator[101]. This raises some serious questions about New Zealand's ability not only to develop in the future, but also to maintain any competitive advantages that have already accrued as a result of extensive development and uptake of infrastrucutre. For instance:

- Can New Zealand maintain its current position as a world leader in infrastructure and thus economic commerce activity largely as an adopter of other nations' innovation?
- Is this a desirable future policy for New Zealand?
- Are new policies required even to maintain the current position?
- And what are the policy requirements and implications if New Zealand is to become more pro-active as an innovating nation?

While it is beyond the scope of this paper to address these issues, we raise them as consequences of the analyses undertaken in this research.

Clearly, it would not be to New Zealand's advantage to make substantial changes to the policy environment which has encouraged the current state. Indeed, both the OECD Local Access

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[97] ITAG (1999).

[98] Much publicity has been given in recent months to the apparent increase in emigration by both recent graduates and skilled experienced workers (e.g. *Bright Flight, Bright Lights*, Evening Post 12/8/00). This is compounded by active recruitment strategies and immigration incentives provided by both Australia (NOIE (1999) *Providing for the Future IT&T Skill Needs*) and the USA (FTC *Digital Economy* (2000)).

[99] Stern, Porter and Furman (2000).

[100] ITAG (1999).

[101] Although we believe that there is some over-reporting of R&D spending where countries have a specific tax deduction for such spending, unlike New Zealand where no such incentive exists.

Pricing and E-Commerce[102] and Atkins studies[103] carry direct cautions against such actions in the telecommunications area. Rather, the findings of this study tend towards identifying the need to address the maintenance and development of the country's human capital infrastructure as the key to stimulating future developments.

[102] Urging against a "retrograde step that would return policy makers to setting telecommunications tariffs" p 5.

[103] "Using public access as a means to overcome infrastructure problems would be a retrograde move for the 50% already using the Internet at their rural residence or rural place of business. As the rural community has already shown a highly significant commitment to entering the Information Age in order to be able to fully participate in a wired society and in the Information Economy, why turn back the clock?" Atkins (2000) p 47.

Conclusion

By bringing together a variety of measures and observations from the Internet, Telecommunications and Banking sectors, our study reveals that New Zealand is indeed a world leader in both preparedness and uptake of electronic commerce. New Zealand belongs to a select group of nations in this respect – the United States, Canada and Australia. Significantly, though, by most measures New Zealand leads its near neighbour Australia by a considerable margin.

The foundations for this adoption have been based primarily upon a sophisticated and e-literate population commercially attuned to the concepts of electronic commerce by early, extended and now almost universal exposure to electronic banking, and affordable 'always on' access to the Internet. Thus, the preparedness for and uptake of electronic commerce penetrates deep into the consumer and small business (particularly retail) sectors previously thought to be among the less ready to adopt the new ways of electronic trading.

However, New Zealanders cannot afford to become complacent. The environment which has stimulated the current world-leading position must be maintained and enhanced if future benefits are to be gained. Clearly, changes to the operation of any of the three key infrastructural sectors stand to influence the current rates of adoption and uptake. Furthermore, it is by no means certain, due to the relative "newness" of the phenomenon of electronic commerce, that these are the only key drivers. The Internet itself will inevitably also be only a precursor to other emergent technologies for information-based transacting. Ongoing research is required to identify and validate other current and emerging influences upon both electronic commerce generally, and an information-based economy specifically. For as we noted at the outset of this article, the "traditional" measures used to date are really only proxies based upon Internet technology factors. Furthermore the role of content in the development of electronic commerce is an increasingly important factor, requiring monitoring and measurement.

In addition, attention must be paid also to the concomitant need to develop New Zealand's human capital infrastructure alongside the technological infrastructure if full benefits are to be realised. As we have demonstrated, technologies such as electronic banking, have played a significant role in developing an e-literate population and preparing an "e-aware" culture, and have thus been a significant factor in creating an environment conducive to developing new

ways of doing business. It is vital that future policy developments recognise the existence of this foundation and build upon it, and do not take steps which impinge upon or degrade the base that has evolved.

The stakes are high. New Zealand is well prepared, but the real challenge is whether this preparation can be leveraged into real long-term and sustainable advantages for New Zealand citizens. And the answers to this lie not in the technologies themselves, but in their ultimate applications.

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