

DRAFT

The Digital Divide and Māori

Report for Te Puni Kōkiri

Prepared by Infometrics Ltd

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Executive summary

Māori access to digital technology is an important, but not the only, element of any process to close the gap between Māori and non-Māori incomes.

Māori own fewer computers than non-Māori, use the Internet less, are less likely to be employed in occupations that use computers, and are not as likely to train to be IT specialists.

As the percentage of jobs requiring IT skills grows, and as industries which use digital technologies pull ahead of others, the “digital divide” between Māori and others will become increasingly costly. Not just for Māori, but for New Zealand as a whole.

In this paper, we look at some methods for closing the digital divide. But it isn't clear that spending on computers and computer skills is necessarily the best way to do this.

Firstly, we need to identify the gap we ultimately think should be closed. Access to computers is associated with higher incomes and more employment, but access to computers alone will not achieve these. Other skills (some basic, some advanced) will be necessary. So closing the income gap might be best achieved by focussing on general education, rather than exclusively on digital technology.

Secondly, if we think we have identified the right gap to close – say, income – do Māori actually want it closed? Trying to turn a Māori farmer into a technology entrepreneur is unlikely to be effective if the farmer enjoys farming! There is evidence that some Māori who lack access to digital technology do want the gap closed, but it is easy to forget that not everybody is in this camp.

And thirdly, if we have identified a gap that should be closed, and those targeted want it closed, is the spending justified? Not necessarily. There are many people who would like to receive a government subsidy, but funds are limited. A case must be made that communities cannot “bridge the divide” themselves, or with assistance from the business communities. And that if they cannot, that the benefits of the spending will exceed the costs, bearing in mind that public funds could otherwise be spent on education, or health.

Despite these rather stringent requirements, we can see areas where spending on closing the digital divide is likely to be justifiable and sensible. But they are limited. Our suggestion is that the first in line for funds should be educators. When used sensibly, computers boost student performance across a range of academic subjects, and it seems likely that education, more than anything, will improve Māori incomes and employment outcomes. The cost of computer assisted learning can be low too, provided the right sorts of technology are used.

Introduction

The recent and rapid spread of digital technology has been the cause of much of economic growth, both in New Zealand and overseas. If the hype is to be believed, it will continue to underpin economic performance.

But increased dependence on computer systems and telecommunications networks has consequences for more than the overall level of gross domestic product. Questions are also being asked about the effect of digital technology on the *distribution* of income.

In New Zealand, as in most western industrialised countries, there is a substantial minority of the population without ready access to the digital technologies which have driven, and will continue to drive, economic growth.

And this lack of access is expected to lead to a widening gap between the standard of living of the digital technology “haves” and “have-nots” – a *digital divide*. Indeed, there is evidence such a gap already exists.

Policy makers are concerned about a looming digital divide, because it potentially constrains the productivity of a significant proportion of the workforce and, by implication, holds back this country’s international competitiveness.

Motivated by such concerns, and by its role in helping Māori to achieve their development aims, Te Puni Kōkiri has contracted Infometrics to examine whether there is a digital divide between groups of Māori and the rest of the population.

Our goals in this paper are:

- To establish the existence (or otherwise) of a digital divide between groups of Māori and the rest of the population.
- To establish the effects of the digital divide, if any, on Māori.
- To recommend economically efficient means for closing the digital divide between Māori and the rest of the population, if such a divide is found to exist.

In the first part of this paper, we will define the digital divide. In the second part of the paper, we will compare Māori access to digital technologies to that of other groups in the population, and attempt to provide some reasons for the differences we find. In the third part of the paper, we will identify the effects of a digital divide. In the fourth part of this paper, we will consider possible remedies for the lack of access to digital technologies amongst some Māori. We conclude with a summary of our findings, and provide recommendations.

We have not attempted to produce an academic treatise (in several places, we will posit causal relationships when there is only hard evidence of correlations, for instance). Rather, this paper is intended to be a starting point for further research on particular policy initiatives, and to promote debate on what has been an issue with a relatively low public profile to date.

Background

What is the digital divide?

There has always been a gap between the access to important services enjoyed by New Zealand's rural areas, and the access available to city-dwellers. The biggest hospitals and tertiary institutions have always been in or close to major population centres, road and rail services generally have higher capacities in metropolitan areas, and even basic telephone access has been more limited in some rural regions (party lines persisted in some areas well beyond the privatisation of telephone services in the late 1980s).

However, while the economy here and in other countries was based on primary production (some time ago) or large-scale basic manufacturing (much more recently) this issue was arguably not a vital one. Provided adequate transport links were available for the dominant goods-based industries, isolated regions did not suffer severe disadvantages.

The changing nature of economic production, and in particular the increasing focus on the delivery of services rather than goods, has changed all this. *Information* is now recognised as an important and distinct input to the production process in developed economies. Intellectual property, rather than land, financial or physical capital, was behind the substantial growth in wealth creation in the United States and other major western economies over the 1990s (the decline in share values over the last year notwithstanding).

The increasing importance of intellectual property was due to many factors.

One was the growing ease of raising financial capital, which had previously been a barrier to budding entrepreneurs. With liberalisation of international capital markets, the privileged access to credit, and therefore the ability to invest in physical capital, enjoyed by medium-sized to large companies in developed countries, disappeared. The new source of competitive advantage was skills – in the absence of market imperfections, countries specialise in the areas where they have large factor endowments, and developed countries have more educated workforces.

Another reason, and perhaps the most important, for the increased importance of intellectual capital, was the rapid development, falling cost, and rising availability of digital technologies. Digital technologies enable the communication, storage and manipulation of intellectual material. Intellectual capital may also be applied, with the aid of digital technology, in very productive ways in traditional industries such as manufacturing.

The relative success of companies based on intellectual capital – software-maker Microsoft is the example most often cited – and the general incorporation of digital technologies into production processes and (increasingly) daily life, has raised questions about the ability of those in areas where information is not easily received or transmitted, to maintain parity with those in areas where it is.

Anecdotal and statistical evidence has been presented in recent years showing an increasing disparity in access to digital technology (and therefore information) for:

- Those in urban areas compared to those in rural areas
- Those with high income compared to those with low income
- Different racial groups

These gaps, collectively, are known as the “digital divide”.

Digital technology incorporates both computing technology (computers, embedded computing devices) and the infrastructure used to send digital data between computers – telephone networks, satellite connections).

Divides in access to both these components of digital technology have been noted in many publications, both in New Zealand and overseas. Our next task is to summarise the evidence that those publications present.

Key Issues

1. Evidence for a digital divide

There is strong evidence for a digital divide of some sort, both in this country and abroad.

New Zealand

In New Zealand, there is evidence of digital divides based on: ¹

- Income (low and high)
- Education (highly qualified and less qualified)
- Location (urban and rural)
- Ethnic group (Māori, Pacific Island, and other)

Our task here is to concentrate on the ethnic divide, but there is clearly some correlation between ethnicity and the other variables. Māori, for instance, tend to have lower average levels of education than European New Zealanders. We will return to this point.

In New Zealand, and compared to all other ethnic groups combined, Māori:

- Are under-represented in IT-related occupations
- Are under-represented in IT education courses
- Have lower computer ownership rates
- Have lower Internet usage rates
- Are less likely to use new voice communications technologies.

IT-related occupations

It is useful to distinguish between two types of IT-related occupations.

Firstly, we consider those occupations where manipulation of digital technology is the primary task – computer programmer, computer operator, computer maintenance

¹ Much of this information is taken from Te Puni Kōkiri (forthcoming), *Māori Access to Information Technology*.

worker, IT manager.² Data from the Statistics New Zealand 1996 Census show that there were 25,020 people employed in these occupations. 1,740, or 7% of these people, were Māori. Since Māori make up 12% of employment across all industries, we can say that they were under-represented in occupations where digital technology is of primary importance. Furthermore, those Māori that were pursuing such occupations full-time were not as well paid as people of other ethnicities. This may be due to Māori holding less skilled positions within each of the occupational groups, or other factors.

The second group of IT-related occupations is that where computer skills are required, but are only of secondary importance. Some examples include accountant, policy analyst, bank teller, and commercial printer. People in these occupations are expected to be able to operate computers, but most of their formal training or experience will be in a discipline other than IT. Although computers are increasingly common in almost all occupations, we have identified two broad occupational categories where computer skills are likely to be most important: professionals; and technicians and associate professionals.³

In 1996, 186,717 people were employed in these occupations. 8% of these people were of Māori ethnicity, again implying that Māori are under-represented. As in occupations where IT is of primary importance, Māori were paid less than others in these occupations. Once again, this may be due to Māori holding less skilled positions within each of the occupational groups (junior accountants rather than auditors, for example), or other factors.

IT Education

In 1999, Māori made up 12.2% of enrolments in post-secondary computing courses. Māori make up 13.5% of all tertiary students, so Māori are slightly under-represented in IT education. The gap between Māori and non-Māori in this area has been closing (Māori were just 8.4% of enrolments in computing courses in 1994).

However, other gaps are still concerning. For example, while the proportion of Māori in computing courses is rising, they tend to be concentrated in less advanced programmes. In 1999, Māori made up 23% of graduates from computer awareness programmes, but only 10% of computer programming and analysis graduates.

Computer ownership⁴

In 2000, only 34% of Māori households had a computer, compared to 38% of Pacific Islanders and 51% of Europeans. Within the group of computer-owning households, Māori were the ethnic group that made the least use of the computer for word processing and internet access, although they made more use of the computer for school homework than Europeans.

² We have used the following New Zealand Standard Occupational Classification (1995) categories: 12271 (Computing Services Manager), 213 (Computing Professionals), 31142 (Computer Systems Technician), 312 (Computer Equipment Controllers), 41121 (Data Entry Operator).

³ New Zealand Standard Classification of Occupations groups 2 and 3. Note that this includes some of the groups where IT skills are of primary importance.

⁴ All figures from ACNielsen, *Netwatch 2000*.

Internet usage

Internet access is a more comprehensive indicator of access to digital technologies than home computer ownership, since Internet access may be available outside the home (in schools, workplaces, or cyber-café, for example).

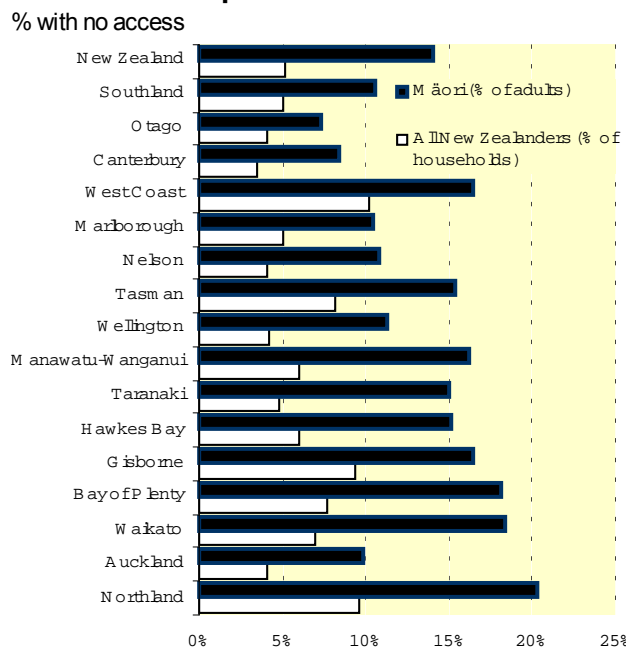
In 2000, 45% of working-age New Zealanders had access to the Internet, but only 26% of Māori could say the same (Pacific Islanders had the lowest rate of access, at 12%).⁵ The cost of access was a particularly important barrier to Māori wanting to use, but not using, the Internet. This suggests income differences are a likely cause of the digital divide. Another barrier to the Internet in the case of access from home was the lack of a telephone line. This is covered in more detail below.

As a result of reduced Internet access, Māori were less likely than European New Zealanders to use the World Wide Web, Internet e-mail, or make purchases across the Web.

Voice communications technologies

Voice communications technologies can be broadly split into two types – analogue and digital. While access to digital voice technologies concern us directly here, access to analogue technologies is also important, since analogue telephone lines can provide access to the Internet. Census figures indicate that in 1996 Māori households had, on average, less access to telephones in the home than other ethnic groups. While only 5% of all New Zealand homes were without a phone, 14% of Māori adults did not possess one.⁶ The lack of access was particularly severe in rural regions.

No access to a phone at home



Source: 1996 Census

⁵ Ministry of Social Policy/ACNielsen, *Survey of Working-Age People in 2000*.

⁶ The figures are not strictly comparable. Figures for all New Zealanders count households, while figures for Māori count adults. If there are more adults, on average, in households without phones (and this is likely) the actual gap is likely to be smaller than the one presented here, though still significant.

Māori access to cell phones (38% of respondents) is also marginally lower than that of Europeans (44%)⁷. This may not yet be a major impediment to accessing technologies such as the Internet, but this will change as new “third generation” cell-phones make mobile Internet access, including multimedia streaming, practical.

For those in rural regions, even owning a telephone does not necessarily permit reliable access to technology (this is a general issue for rural areas, rather than specifically a Māori one, but Māori are over-represented in rural areas).

The Ministerial Inquiry Into Telecommunications commented that a significant minority of those in rural areas experienced problems with line quality, slow Internet access speed, exchange overloading, and more mobile phone coverage.⁸ 5% of the lines in Telecom’s national network do not have a reliable data speed of 14 kilobits per second (kbs - the absolute minimum necessary for browsing the Internet). For around half those lines, however, the cause of the problem is not Telecom (electric fence interference with lines, for example, is a factor).

We note that it is necessary to be wary of generalisations when discussing rural access to digital technologies. A recent study analysed Yellow Pages listings to determine the proportion of businesses in defined geographic areas with a web or e-mail address.⁹ One finding of the paper was that although some rural areas – particularly those in the Central North Island – exhibited lower rates of new technology adoption than their urban counterparts, others had comparatively high rates of use of some technology (especially e-mail). This will be important in considering remedies to the digital divide, as in our view the finding argues against a “one size fits all policy”.

International

The finding that there is a digital divide in New Zealand tallies with evidence from the United States¹⁰, which found that there were gaps between white and hispanic households, and white and black households, and that these grew over the period 1997-1999, except for the wealthiest groups within these categories.

Inter-country studies also suggest a link between the stage of economic development of countries and the extent to which technology access is available.¹¹ To the extent that different ethnic groups are concentrated in different countries, this also implies an ethnic digital divide.

With plenty of national and international evidence for digital divides between ethnic groups, it is tempting to conclude that our job is done, that we can now begin the search for solutions. But effective solutions need to be aimed at the root cause of the

⁷ Source: ACNielsen Netwatch 2000, quoted in “Māori Access to Information Technology” Te Puni Kōkiri, July 2001

⁸ Ministerial Inquiry into Telecommunications (2000), Final Report, Chapter 9, <http://www.teleinquiry.govt.nz/reports/final/index.html>.

⁹ Howell, Bronwyn (2000), *The Rural-Urban Digital Divide in New Zealand: Fact or Fable?*, New Zealand Institute for the Study of Competition and Regulation Inc. An updated version of this paper is forthcoming in *Prometheus* 19(3).

¹⁰ NTIA (1999), *Falling Through the Net: Defining the Digital Divide*, <http://www.ntia.doc.gov/ntiahome/fttn99/contents.html>; Also Meares (1999), Op. Cit.

¹¹ United Nations Development Project (1999), Human Development Report 1999, pp. 57-76. (<http://www.undp.org/hdro/report.html>)

divide, and despite the statistical evidence presented so far, that root cause might not be race.

Is the digital divide race-determined?

There is no doubt, given the data available to us, that Māori have less access to digital technology than European New Zealanders. However, the fact that ethnicity and access to technology are correlated does not imply that one causes the other. Rather, it may be that low income, low levels of education, and a greater concentration of population in rural areas – all things also correlated with Māori ethnicity – are the cause of low Māori rates of technology take-up. Indeed, in some ways this would be a more satisfactory explanation as it could also be used to explain low usage rates of digital technology for other minority ethnic groups, those in developing countries, and European New Zealanders on low incomes.

What appears more likely though is that both race and these other factors work together to determine the rate of uptake of, and access to, digital technologies. In the absence of quantitative New Zealand research on the exact role race plays (we have not sighted any) we have used overseas work to try and give some guidance here. We are particularly wary of extending findings relating to an ethnic minority on one country to an ethnic minority in another, but perhaps the doubtful nature of such extension will prompt more quantitative research in this country.

Hoffman and Novak (1998), in “Bridging the Digital Divide”, found that in the United States:

- There was no significant difference between whites and blacks in the rate of computer ownership, once *income* was accounted for (that is, whites and blacks on the same incomes were equally likely to own a computer). However, blacks with the same *level of educational achievement* as whites were less likely to own a computer (that is, race appears to be a significant determinant of computer ownership because blacks have lower incomes than whites, even with the same level of education)
- There was no significant difference between whites and blacks in the rate of access to a computer at work, once levels of educational achievement were accounted for. However, blacks with the same income as whites were *more* likely to have access to a computer at work, partly but not completely because the black population is younger, on average, and more likely to be working in computer-related occupations (if employed).

We conclude that race is likely to be a determinant of access to digital technology, though only one of many. Cultural factors may be important in uptake, but income and education are also important. Once age and occupational bias are included, the role for ethnicity is minor.

We want to stress that our conclusions cannot easily be transferred from one country to another. A major difference between Māori and Black Americans is the geographic dispersion of these ethnic groups. For example, there are significant concentrations of Māori in isolated rural areas, whereas in the United States, Black Americans are predominantly city-dwellers (see table below).

Population by location

Maori as % of total NZ population

| | |
|-----------------------|-----|
| Main urban areas | 13% |
| Secondary urban areas | 15% |
| Minor urban areas | 24% |
| Rural areas | 18% |
| Total NZ | 15% |

Source: 1996 Census, excluding those not specifying

United States population by location

Black population as % of total US population

| | |
|--|-----|
| Metropolitan areas, in central cities | 22% |
| Metropolitan areas, outside central cities | 8% |
| Outside metropolitan areas | 9% |
| Total US | 12% |

Source: 2000 Census, those specifying a single race

We also note that just because ethnicity is not the root cause of some digital divides, policy initiatives may still be usefully targeted by race on practical grounds (see below). Furthermore, even if ethnicity is not the cause of the digital divide at all, the fact that Māori are over-represented in groups which are deprived of access to technology is still seriously concerning from the viewpoint of an organisation such as Te Puni Kokiri.

2. Analysis of the implications of the digital divide for Māori.

The international and national literature on the digital divide considers that the increasingly widespread delivery and manipulation of information via digital technology means while it is not essential for survival, access to digital technology is in some weaker sense, essential.

What the literature really means is that the digital divide between Māori and others might have negative implications for:

- The relative educational achievement of Māori
- The relative level of employment of Māori, and the income earned in that employment
- The rate of growth of Māori -owned businesses
- Social cohesion between Māori and other groups, and within Māori communities

Education

It seems obvious that if digital technology is used in schools to teach students how to use computers, this will provide later benefits for those moving into IT-related jobs. However, these benefits are narrowly based, and have not been the main justification for the introduction of such technology into the education system. Rather, providers of digital technology, and some educators, have argued that computers provide more general benefits, aiding learning in all (or at least many) subject areas.

A comprehensive report has reviewed the (copious) United States evidence on the effect of computers.¹² Findings included:

- Using technology to support instruction can improve student outcomes in a wide range of subjects
- Computer-aided instruction (CAI) is a more cost-effective way of improving student outcomes than tutoring, increasing instruction time, or decreasing class size
- CAI is particularly effective in improving the performance of low achieving and remedial students
- Connectivity (principally e-mail and Internet access) improves student motivation
- Connectivity helps teachers and others to better help students
- Connectivity helps parents become more involved in their childrens' education.

A preliminary study in New Zealand supports at least the last of these findings, with three-quarters of children in a Cannon's Creek "Computers in Homes" scheme spending thirty to sixty minutes a day doing things with their parents on a computer.¹³

If these findings are correct, then the fact that Māori have less access to digital technologies is likely to be detrimental to their education outcomes, if not in absolute terms then at least relative to the rest of the population.

¹² McKinsey & Co. (c. 1995), "Connecting K-12 Schools to the Information Superhighway", Report to the National Information Infrastructure Advisory Council, <http://www.uark.edu/mckinsey>.

¹³ 2020 Communications Trust (2000), "Computers in Homes: Progress Report 1, 7 November 2000"

We should note that not everybody agrees that computers have a positive effect in the classroom. There is research which finds that CAI:¹⁴

- Does not properly develop nonverbal reasoning skills, because computers stimulate at most two senses (hearing and sight)
- Can reduce creativity (one reading-assistance programme was found to be particularly harmful)
- Might force students to think in a sequential, rather than parallel, manner, because the computer screen flattens data into a narrow, sequential form
- Might discourage students to think about the processes underlying what they see on the screen.

We do not see these as arguments against a role for computers in enhancing learning across the entire curriculum. Rather, they stress that CAI will only be successful if used in combination with other (existing) teaching methods. Although there is argument about overall benefits, there are broad areas of agreement – for example, there is little evidence against the finding that computers are helpful to the least academically successful children.

Education has become an increasingly important determinant of employment prospects over recent decades, as cheaper and more efficient capital equipment has replaced manual labour. Under-representation in education, and particularly in higher education, is one reason for the divergence between Māori and non-Māori unemployment rates (both were approximately zero in the 1960s, but the Māori rate appears to have settled at around double the non-Māori rate in the 1990s).¹⁵

Employment and incomes

In 1984, 25% of jobs in the United States required familiarity with computer and/or networking. By 1993, that figure was 47%, with further rises forecast.¹⁶ We have no hard statistical evidence to hand for New Zealand, but we suspect a similar trend in this country. For Māori therefore, a lack of exposure to digital technologies will dramatically reduce the opportunity for employment in the future.

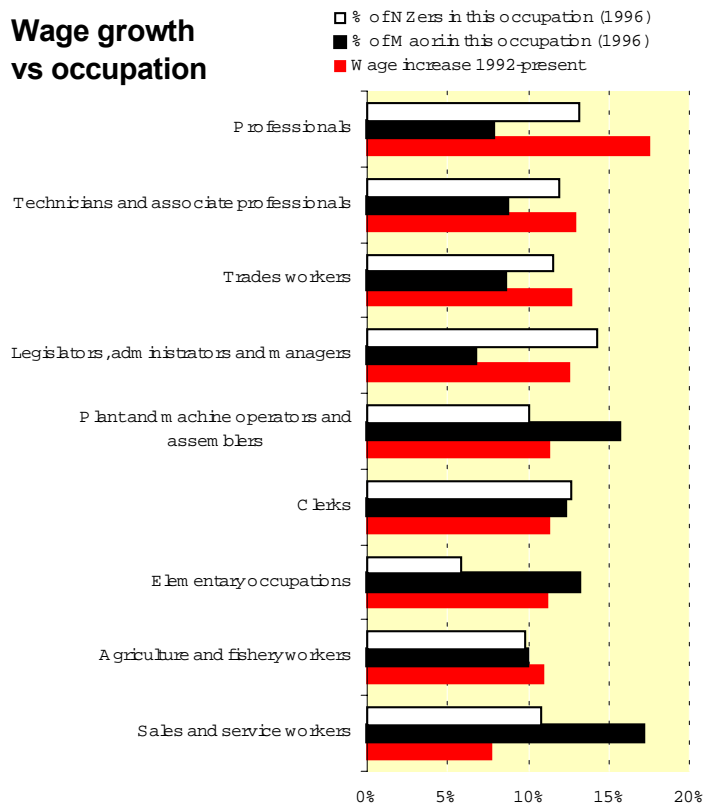
Furthermore, even those who manage to gain employment in non-computer-intensive industries are likely to be at a relative disadvantage. As well as wages in computer-intensive occupations starting from a higher level than those in other jobs (see above), over the last decade, wages for those in computer-intensive occupations have been the fastest growing in the economy. That is, any disadvantage to Māori from lack of exposure to digital technology is likely to carry an increasing income penalty over time.

¹⁴ Oppenheimer, Todd (1997), “The Computer Delusion”, The Atlantic Monthly: Digital Edition (July), <http://www.theatlantic.com/issues/97july/computer.htm>.

¹⁵ There are of course other reasons. The role of the welfare system and inter-generational welfare dependence has also frequently been cited. See for example, “Māori and Work: The Position of Māori in the New Zealand Labour Market” Manatu Māori, 1991.

¹⁶ McKinsey & Co. (c. 1995), *Op. Cit.*

Wage growth vs occupation



At 1996 wage levels, our calculations show that if Māori raised their participation in IT-specific careers¹⁷ to the same level as other ethnic groups, the average wage for full-time employed Māori individuals would be \$22,214, 0.5% better than otherwise. If they then also raised their average wage within those careers to the same level as other ethnic groups, there would be a further 0.6% increase in incomes.

If Māori raised their participation in the wider occupational group where IT skills are necessary but not the primary focus to the same level as other ethnic groups, Māori average incomes for full-time employed would be approximately \$22,753 or 2.9% higher than otherwise. Raising average wages within these occupations to non-Māori levels would result in a further 9.1% improvement.¹⁸

We should stress here that it is not necessarily desirable for Māori to pursue the same occupations as non-Māori. While this will produce gains in market income, Māori may have a preference for other occupations. We will comment more on this in later paragraphs. We have merely used the analysis here to indicate the general magnitude of impacts of the digital divide.

We should also stress that closing the digital divide, while a necessary step for enabling greater Māori participation in higher-paying occupations, will not be sufficient. Other skills will also be required – advanced literacy for all workers in

¹⁷ We differentiate between IT-specific occupations, where computer skills are the major skill required, and occupations where IT is used as an important tool, but is not the primary focus. See above for a classification of these occupations.

¹⁸ We have exact data for IT-specific occupations. For the wider occupational groups, we have data only by income bands, so our results here are approximate.

these fields, accounting for accountants, law for lawyers, and so on. Policymakers will need to be careful not to lose perspective.

Business growth

Digital technologies:

- Aid productivity growth – productivity gains scored by those in technology-oriented United States businesses were 2.7 times greater than those of other businesses over the year 2000.¹⁹
- Potentially reduce distribution costs – with Internet technologies increasing the reach of both suppliers and buyers, more complex purchase choices can be made at low cost. This reduces the need to hire specialist intermediaries – buyers, wholesalers, agents. In some industries, an already-short supply chain and high transport costs of physical goods will nullify this benefit (log exporting might be an example).
- Potentially increase market size – the Internet potentially makes a global market available to businesses. Costly transportation of physical goods may nullify these benefits, however.

An analysis of the world's fastest growing industries over the 1990s provides some illustration of the positive effects of digital technology. In the United States, the United Kingdom and Japan, IT-intensive service industries were in almost all cases the fastest growing over this period. There has been faster growth in telecommunications, and in some parts of the manufacturing sector, but this growth has often been related to digital technology too (rapid uptake of data communications technology, semiconductor manufacturing).

New Zealand's growth pattern is somewhat different, although communications still leads the charge, and services (excluding government) are nowhere near the bottom of the table. It is interesting to note that although agriculture was one of the slowest growing industries in the United States, it grew nearly as fast as this country's agriculture sector, which was one of our best-performing.

¹⁹ PricewaterhouseCoopers (2001), "Technology Businesses Report Productivity Growth of 11.2 Percent for 2000; 13.6 Percent Targeted for 2001, PwC Finds", 8 March 2001, <http://www.pwcglobal.com/extweb/ncpressrelease.nsf/docid/9F5885E363BCAAC985256A09004AFD11?OpenDocument>. Prior to the late-1990s, some observers had questioned the usefulness of digital technologies in improving productivity. For a survey, see Lefebvre, Élisabeth and Louis A. Lefebvre (1996), *Information and Telecommunication Technologies: The Impact of Their Adoption on Small and Medium-sized Enterprises*, Chapter 4, <http://www.idrc.ca/books/focus/807/chp04.html#Heading8>. However, strong productivity growth in recent years, in the United States at least, means the "productivity paradox" they cited appears not to have persisted.

GDP growth by industry, United States*1991-2001, % growth in real gross domestic product*

| | |
|--------------------------------------|------|
| Communications | 107% |
| Finance, insurance, and real estate | 97% |
| Construction | 90% |
| Transportation | 85% |
| Retail trade | 80% |
| Wholesale trade | 79% |
| All industries | 72% |
| Electric, gas, and sanitary services | 58% |
| Government | 45% |
| Mining | 45% |
| Manufacturing | 41% |
| Agriculture, forestry, and fishing | 32% |

*Source: US Bureau of Economic Analysis***United Kingdom***1990-2000, % growth in real gross domestic product*

| | |
|---|-----|
| Transport, storage and communications | 65% |
| Mining and quarrying including oil and gas extraction | 46% |
| Business services and insurance | 41% |
| Electricity, gas and water supply | 31% |
| All industries | 24% |
| Distribution, hotels and catering; repairs | 23% |
| Other services | 22% |
| Manufacturing | 6% |
| Agriculture, forestry and fishing | 1% |
| Construction | -2% |

Source: UK Office of National Statistics

Japan*1990-2000, % growth in real gross domestic product*

| | |
|--|------|
| Producers of private non-profit services to households | 33% |
| Finance and insurance | 32% |
| Wholesale and retail trade | 32% |
| Transport and communications | 27% |
| Service activities | 27% |
| Electricity ,gas and water supply | 23% |
| Producers of government services | 20% |
| Real estate | 20% |
| All industries | 13% |
| Manufacturing | 4% |
| Construction | -23% |
| Agriculture ,forestry and fishing | -29% |
| Mining | -39% |

*Source: Japan Economic and Social Research Institute***GDP growth by industry, New Zealand***1991-2001, % growth in real gross domestic product*

| | |
|---|------|
| Transport, storage, and communication services | 112% |
| Education, health, cultural, recreation, personal, and other services | 48% |
| Agriculture | 36% |
| Wholesale trade | 32% |
| Total | 32% |
| Retail trade, accommodation, cafes, and restaurants | 31% |
| Finance, insurance, property, and business services | 26% |
| Manufacturing | 25% |
| Forestry, fishing, and mining | 20% |
| Construction | 10% |
| Electricity, gas, and water | 2% |
| Government administration and defence | -2% |

Source: Statistics NZ

Based on the limited analysis we have undertaken, we cannot say that digital technology has *caused* the superior growth in the service sector world-wide, but we can say that involvement in the fastest growing sectors has been *correlated* with digital technology adoption overseas.

Māori have so far been slow to penetrate IT-intensive, high-end service industries. 82% of Māori business assets are in the primary production sector.²⁰ If this percentage does not fall, and the broad international growth trends of the last decade persist, the cost will be a declining share of total economic revenue for Māori businesses.

One barrier to increasing Māori involvement in IT-intensive businesses is location. Due to historical accident, the availability of suitable land, or proximity to stakeholders, existing Māori industries are based in many cases in rural areas. As already mentioned, telecommunications technology is not as advanced in these locations.

The Telecommunications Inquiry noted that “...New Zealanders living in urban areas will have access to broadband services in the near to medium term at affordable prices. However, for people living in rural areas, the availability of affordable broadband services is likely to be more problematic in the absence of specific initiatives to address this problem.”²¹

While the broadband communications necessary for businesses might be available through non-traditional channels (such as satellite, which is commonly used in Gisborne), Māori businesses requiring high communications bandwidth are likely to find operations more costly in current locations.

*Social cohesion*²²

While the impact of digital technologies on education, employment and business development can be translated relatively straightforwardly into the impact on incomes, some researchers have also postulated non-income benefits.

The preliminary results of research into the Computers in Homes project²³ show that the introduction of digital technology into a deprived community led to some families regularly using e-mail to communicate with others in their communities and further afield. In some cases, face-to-face alternatives to such communication would not have been possible. Families also had wider access to news. As previously mentioned, another positive impact of digital technologies in this project was that parents spent time with their children while working on computers.

Beamish (1999) indicates that communications between and among residents in a community and government might be improved by the use of new digital technology. Technology can also help non-profit community organisations “to communicate, research, and manage more effectively as well as foster a sense of collaboration and community”.²⁴

²⁰ Te Puni Kōkiri (2000), *Op Cit*.

²¹ Ministerial Inquiry into Telecommunications (2000), *Op Cit*, p. 92.

²² We are a little uncomfortable with this term, as its meaning and importance for economic growth are unclear. To some extent, we are using it as a “catch-all” for non-financial benefits, but one of the most important of these benefits is increased communication between members of a community.

²³ 2020 Communications Trust (2000), *Op. Cit*.

²⁴ Beamish, Anne (1999), “Approaches to Community Computing: Bringing Technology to Low-Income Groups”, In D. Schön et al (Eds), *High Technology in Low-Income Communities: Prospects for the Positive Use of Information Technology*. Cambridge, MA: MIT Press. pp. 349-368.

And Turner and Pinkett (2000) find that community-based efforts to close the digital divide can have positive spinoffs, such as increased knowledge about the assets of various types (human resources, capital equipment, businesses) a community possesses.²⁵

Many countries have implemented or are now moving to implement “e-government”, where government services are delivered across the Internet, and in some cases “e-voting” is under active consideration. The non-financial benefits to be derived from access to digital technologies will be substantial if this trend continues, and policy makers will need to take care to ensure that disadvantaged groups – such as Māori – do not suffer a relative disenfranchisement.

From the analysis done so far, we can see that the benefits of digital technology adoption will potentially have large positive impacts on educational achievement, employment growth, business development, and social cohesion.

To the extent that their uptake of this technology lags behind that of the rest of the population, the digital divide will potentially be costly for Māori. It will also be costly for New Zealand – in 1996, Māori accounted for 14.8% of New Zealand’s total population, but this will rise to 22.1% within fifty years.²⁶ It follows that anything that has a detrimental effect on Māori will increasingly weigh on New Zealand as a whole.

However, the presence of a digital divide, or even the fact that such a divide will be costly for some groups in the population, does not on its own provide a case for government (or even private) intervention.

We first need to show that:

- The situation that exists is not in accordance with preferences – as we mentioned in our discussion of Māori occupations, it may be that Māori prefer occupations that do not involve digital technologies. (It may also be that Māori want to take up such occupations and are prevented from doing so, but we cannot rule out other possibilities).
- Any problems identified will not be fixed by the private sector – if individuals in the private sector (Māori or otherwise) are willing to fix the problems, then government assistance will merely “crowd out” that process.
- Government intervention will not cost more than the benefits – government intervention often has unforeseen and costly consequences, and in some cases these can outweigh any benefits. Most importantly, costs should include *opportunity cost*. That is, it is not enough to show that benefits exceed costs. We also need to show that other uses of the money (tax cuts, spending on health, etc.) would not produce greater benefits.

We will consider these issues in the next section.

²⁵ Turner, Nicole E. and Randal D. Pinkett (2000), *Closing the Digital Divide: An Asset-Based Approach to Community Building and Community Technology*, Asset-Based Community Development Institute, Northwestern University, Illinois.

²⁶ Source: Statistics NZ projections.

3. Closing the digital divide for Māori.

We propose a general microeconomic framework for deciding on the most efficient means for closing the digital divide for Māori communities, while noting that it is at least possible that not closing the divide may be the most economically efficient solution.

The process is as follows:

- i. Seek to identify digital divides
- ii. Decide whether or not these divides are due to freely made choices and free market interactions, with no externalities
- iii. If (and only if) divides are *not* due to freely made choices and free market interactions, with no externalities, identify policies which will close (or reduce) the divide at least social cost
- iv. Weigh social cost against social benefit and proceed only if benefits exceed costs by some arbitrarily specified amount (usually determined by funding constraints of the agency funding the policy)

The first of these steps has been addressed in the previous section – there is good evidence that a digital divide between Māori and non-Māori exists. We address the rest in what follows.

Are divides due to freely made choices?

It is a fundamental theorem of welfare economics that if choices are freely made in a free market, and there are no major externalities (or other substantial failings of the market), the outcome will be “pareto optimal”. This means that nobody can be made better off without making somebody else worse off. There might be more than one “pareto optimal” outcome, but nobody is qualified to say which is “best” because individuals’ preferences are not easily comparable. In a pareto-optimal situation, it is probably unwise for the government to intervene to try and “fix” things.²⁷

Consistent with this school of thought, Charles Tiebout²⁸ outlined a theory of local government which implies people living in “deprived” regions were there of their own free will. They made a choice about where to live that maximised their utility (well-being) from public goods. If Tiebout was right, there would be little justification for rewarding those in deprived areas for freely making a choice (by delivering them some sort of subsidy to allow access to digital technology) and not those in other areas.

²⁷ This theorem relies on some particularly simplistic assumptions which are unlikely to be satisfied in any real world situation, but the implications of the theorem are still used today because they seem to provide a good approximation to some actual market outcomes (this is the so-called “theory of the second best”). Many markets – e.g. the market for fish and chips – are likely to deliver an outcome which is close to “pareto optimal”. Of course, where there are substantial market failures (externalities, imperfect competition, imperfect information or the like) some government intervention might be warranted.

²⁸ Tiebout, Charles M. (1956), "A Pure Theory of Local Expenditures", *Journal of Political Economy*, (October), pp. 416-424.

Of course, this assumes there are no barriers to people leaving – moving costs, for example.²⁹ And strict adherence to Tiebout’s hypotheses might have some politically awkward implications – for example, the unemployed might be forced to move to take jobs on offer in other regions, or lose their benefits.

But the hypothesis does have its uses. It suggests, for instance, that minimising impediments to migration between regions will result in more “optimal” outcomes for individuals. And it suggests that to the extent that public assistance delivered to rural regions increases the return to living in an area, it might encourage people to remain in areas with costly (in the absence of assistance) access to digital technology when they would otherwise have shifted to areas where it was cheaper.

The conclusion we are coming to here is that if Māori are on the wrong side of the digital divide because of their concentration in rural areas, then Tiebout’s hypothesis implies supplying them with subsidies is unfair to those in urban areas. They have, according to the hypothesis, chosen the best place to live according to their preferences, and there is no reason to reward them for it.

In a similar vein, one might argue that people with little education have made a choice not to invest in human capital. The price of such a choice is a lower wage, but this is a choice that is made freely, and as such is no justification for a subsidy.

This school of thought argues against the closing of the digital divide by government intervention.

However, another school of thought says that there are benefits for the whole of society (called positive externalities) in ensuring that all sections of the population have access to certain services and opportunities. That is, what is individually optimal may not be optimal for society.

Education is one example – a more educated population is likely to improve the health of individuals, as education and health status are linked. But healthier individuals also improve the health status of others in the communities in which they live (and in neighbouring communities if communicable diseases are involved). More educated individuals are also less likely to commit crime, which has benefits for others in the community and outside it.

We note that it would be much more difficult to argue that ownership of computer hardware has positive externalities, since the benefits of owning such hardware would largely accrue to the owners.³⁰

In addition to the “externality” argument for government intervention, one could argue for public subsidies on the ground that equitable access to digital technologies is a social policy (rather than a purely economic) issue. To the extent that some

²⁹ There are other simplifying assumptions, one being that availability of work is not a factor in location choice. This is unrealistic, although it is more likely to be valid when welfare benefits are substantial.

³⁰ So called “network externalities” can be created when people link computer hardware (as, say, through the Internet). As more people join the network, the value of the network to those already in it rises. But ownership of a personal computer on its own is of little benefit to others.

members of communities cannot make free choices, particularly children, policy intervention may be called for. Ability to participate in the democratic process may also be a concern here:

The new technologies of information are not simply tools of private communication as a telephone is, or tools of entertainment as a television is. They provide direct access to information sources that are essential in making social choices and keeping track of developments not only in the world at large, but also within their immediate neighborhoods.³¹

In this section so far, we have looked at the justification for delivering assistance to individuals, and have seen that this is a controversial area.

When the analysis is extended to businesses, the issue becomes even more fraught. Businesses are generally freer than individuals to make decisions about investment (businesses are free to move between regions, and are rarely dictated to by their parents!), so arguments about freedom of choice are not easily applied to them.

However, it is still theoretically possible that well-targeted business assistance may have positive externalities. This would need to be looked at on a case by case basis, with a strong bias for not interfering in the market unless a market failure can be demonstrated, and the intervention demonstrably increases social benefits by more than it increases costs.

Finally, freedom of choice and the efficient working of markets are not just important in deciding whether or not public money should be spent on closing the digital divide. These things also help to determine the success of any initiatives that do go ahead.

If initiatives are forced on an unwilling community, then it will be more likely that the initiatives will fail. For example, were a policy maker to introduce a subsidy on education (because of positive externalities), then that subsidy would need to be greatest for the least willing to learn, as the cost of learning is highest for that person.

One way to ensure that communities are willing to participate in initiatives is to pursue “grass-roots” projects. That is, projects suggested by deprived communities themselves. This not only ensures that subsidies will not need to be as high, it is also means that policies are likely to be delivered to a homogenous group of people. In contrast, a policy delivered at a national level is likely to target a group which has wide variation in individual characteristics.

If there is significant variation in access to some digital technologies *within* a group being assisted, as well as *between* them and some other group, then policies can be wasteful. This suggests that a one-size-fits-all approach will be unsuccessful, or at least second-best.

³¹ Hoffman, Donna L. and Thomas P. Novak (1999), *The Evolution of the Digital Divide: Examining the Relationship of Race to Internet Access and Usage Over Time*, <http://www2000.ogsm.vanderbilt.edu/>

Which policies are least-cost, and what are their benefits?

General findings on costs

The costs of initiatives can be split into two broad groups – financial and non-financial costs.

Information on financial costs is not readily available for many initiatives.

However, we do have information on costs for the New Zealand Computers in Homes scheme. The cost per family, including the computer, training, technician support, software, Internet access, telephone connection and project costs is \$3,000.³²

McKinsey & Co. present general costing models for connecting schools to the national information infrastructure in the United States.³³ Without investigating a number of set-ups in schools in New Zealand, we suspect the costs outlined in the United States models would be prohibitive in this country. However, the authors note that less ambitious models are possible, and costs are likely to have fallen since the report was published.

A Brazilian government initiative to make personal computers (with Internet access capabilities) available to the general population expects to provide computers at a final cost of between NZ\$382 and NZ\$477 per new machine. The computers will come with a modern processor and memory, modem, soundcard, monitor, keyboard, mouse, network card and a small amount of permanent storage. An operating system, productivity and Internet software will be included.³⁴

The financial costs of providing hardware for initiatives can be reduced by using recycled computers (see for example <http://www.canz.org.nz/>), perhaps in combination with a thin-client network.³⁵ Software costs can be reduced by using free products. Free operating systems (Linux – <http://www.linux.org>), and free Microsoft-compatible office productivity suites (Star Office - <http://www.sun.com/software/star/staroffice/>) are available, although support costs may be higher with such programs, as they are less user friendly than the most popular commercial software.

In addition to the direct financial costs of initiatives, we need to consider the financial “opportunity cost”. That is, when government money (or private money) is spent on some initiative to close the digital divide, the money is taken away from some other area. The alternative to spending on closing the digital divide may be to spend more on general education, to spend more on health care, or to give tax cuts. We have not attempted to quantify these effects here, but they should not be overlooked.

³² 2020 Communications (2000), *Op. Cit.*

³³ McKinsey & Co. (c. 1995), *Op. Cit.*, Appendix A. <http://www.uark.edu/mckinsey/appendixa.html>.

³⁴ The government’s announcement may be found (in Portuguese) at http://www.mct.gov.br/sobre/noticias/2001/31_01.htm.

³⁵ A “thin-client” network allows software to run from a central server, with client computers serving only as an interface. This permits up-to-date software to be run through older computers with acceptable performance.

If general education, for example, provides a greater return than specific computer education (which it might be expected to, if computer technology's rapid advance makes specific skills obsolete) then spending may be better placed there. In any case, general education spending is likely raise educational achievement, which appears to be a good indirect method for closing the digital divide.

The non-financial costs of initiatives to close the digital divide are often not obvious. During our limited research, we encountered only two examples of such costs.

Research into the Computers in Homes project showed that two-thirds of families involved had some concerns about the impact of digital technology on "family life". Some parents were worried about children accessing unsuitable content on the Internet, or playing games when they should have been doing their homework. Others were plagued by junk e-mail, and some were worried about the electricity costs of running the computer.³⁶

In the United States, some researchers have found that use of computers without adequate use of accompanying traditional methods of teaching can be harmful to students' learning in some areas. Creativity is one attribute which has been found to suffer.³⁷

Moving on from costs to benefits, we split initiatives to close the digital divide into the same four classes we used when looking at the impact of the divide on Māori above – education, employment, business and social cohesion. When identifying the costs and benefits of a project, it will be particularly important to indicate which "gap" is being closed.

As Anne Beamish notes:

*"[A problem...] is the frequent vagueness of community computing's goals and the underlying assumption that the technology itself will automatically improve the lives of low-income residents and their neighborhoods. For example, even though access is inarguably important, we are often unclear about why low-income communities should have access. Could they use it to bring about social change? Political mobilizing? Employment? Education?"*³⁸

Educational achievement

Here we consider those initiatives where computers are aimed at improving the overall education outcomes of a community. That is, we are more focused here on computer-aided learning than on learning about computers.

As we have identified above, education is an area where positive externalities are likely to be significant. Focussing on education would also address concerns about lack of free choice in decision making (where children are not really free to make decisions about investment in human capital).

³⁶ 2020 Communications (2000), *Op. Cit.*, pp. 14-15.

³⁷ Oppenheimer (1997), *Op. Cit.*

³⁸ Beamish (1999), *Op. Cit.*

And as higher levels of education are strongly correlated with access to digital technologies (and income), computer aided instruction which made a measurable difference to general education outcomes would also be likely to increase later use of computers outside the education environment.³⁹

This argues for investment in skill development, rather than physical capital or infrastructure. This skill development can be quite general, since it appears that educational achievement increases income and use of digital technology quite generally. However, the time taken for such education to close the digital divide may be quite long, so it may make sense to target skills with specific relevance to digital technology if a quick closure of the digital divide (that is, getting more Māori to use computers, rather than just improving general education outcomes) is optimal. We will discuss this more in the sub-section on *Employment and income growth* below.

There are many examples of schemes which involve computer-assisted learning. We briefly consider three New Zealand schemes and a survey of United States schemes.

Computers in homes – this is one of a number of initiatives launched by the 20-20 Communications Trust in Wellington. Initially funded by the Wellington City Council, the trust has the aim of making digital technologies more widely available. A pilot programme saw computers introduced to homes with children in them in the economically deprived area of Cannons Creek in Porirua City. The local school was an integral part of the programme, and children were expected to use the computer for at least some school work.

Those in homes that were given computers were trained in how to use them, and were then required to pass that training on to another member of the community. The initiative has been extended to Whakatane. Anecdotal evidence suggests the initiative has led to employment and further education for some adult participants. The effect on children in households that received computers has yet to be gauged quantitatively, but anecdotal evidence to date suggest this will be positive. The 20-20 Communications Trust is now setting up neighbourhood computing centres in Newtown, Wellington, partly with assistance from a commercial partner.

Wairoa.com – a non-profit initiative to create a community computing hub in geographically isolated Wairoa has resulted in 22 surplus computers being installed, each with an Internet connection (the computers were donated). The aim of the scheme is simply to give more people access to computers and the Internet. Wairoa.com is open to the public as a cybercafé. The number of people using the cybercafé rose by 75% per month over the first six months of the scheme, although growth has since levelled off.

Wairoa.com earns some income from cybercafé use, but the main income for the organisation comes from education courses run using the computers. A course run in conjunction with the Eastern Institute of Technology is the biggest source of revenue at present. The people using the computers come from a wide range of age groups

³⁹ The strong linkage between education and use of technology is hardly surprising – literacy is a prerequisite for self-directed use of most types of digital technology, and educated individuals are more likely to be able to pay for computers.

and races, with no obvious gender bias. No formal evaluation of the programme has yet been carried out, partly because it has not been under way for long enough.

Gisborne Intermediate School – a large intermediate school (700 pupils), Gisborne Intermediate has a significant digital technology infrastructure. Information technology is “used to enhance learning in all curriculum areas”. The technology infrastructure is notable for its low cost – 70 computers have been installed, but almost all are recycled PCs, some donated by local businesses. Applications are run from a “thin-client” server, meaning that older PCs are no barrier to running the latest applications. Internet access is provided via a satellite connection, bypassing the low-bandwidth land connections that prevail in the area.⁴⁰

United States programmes – there are many examples of programmes which have tried to increase access to computers and/or the Internet in the United States. McKinsey & Co. (c. 1995, *Op. Cit.*) summarised the results of several hundred studies and indicated a strong positive impact of computer learning across a number of disciplines. While this research is now somewhat outdated (it fails to take much account of the Internet, for instance) findings of a positive impact appear to have continued.

A preliminary study into the Universal Service Fund for Schools and Libraries (referred to as “**E-Rate**”) surveys some of the more recent literature.⁴¹ It notes that although many studies have been plagued by weak research methods, increases in student and teacher motivation are a robust finding. Small increases in test scores are also reported. E-Rate is a programme which aims to ensure students have access to telecommunication and the Internet both at school and in their local community. Through a number of initiatives, E-Rate has reduced the average number of students per instructional computer in the United States from 9.1 in 1993/94 to 5.7 in 1998/99. More exact evaluation of costs and benefits is in train.⁴²

Employment and income growth

Here we include initiatives aimed at getting people into IT-related jobs, which, as stated above, pay higher-than-average salaries. In general, this will require training involving specific types of digital technology, although that training may be more or less advanced. For jobs where use of a computer is necessary but only to support another skill (accountancy, for instance), the training required may be brief. In other occupations (such as network administration), more detail and time will be required.

If skill development is focussed on digital technology rather than being more broadly-based, then some specific physical capital and infrastructure will be prerequisites. In some cases, these will be costly, because training will be aimed at mastering a particular system, which might only be available from a single supplier. This is not such an issue in broadly-based education, as the infrastructure can often be delivered by using low-cost substitutes for commercially available systems.

⁴⁰ http://www.tki.org.nz/r/ict/pedagogy/learningpower/case_gis_e.php, <http://www.gisint.co.nz/>.

⁴¹ The Urban Institute (2000), “E-Rate and the Digital Divide: A Preliminary Analysis From the Integrated Studies of Educational Technology”, report prepared for the Planning and Evaluation Service, U.S. Department of Education.

⁴² See, for example, <http://www.ed.gov/pubs/TLCFFirstYearReport/>

Computer hardware, software, and other infrastructure can often be obtained from commercial suppliers on favourable terms, when used for academic purposes, as there are significant advantages for technology vendors in having people train on their equipment.⁴³ This is an avenue we would recommend be explored further.

We have identified one New Zealand initiative to train more Māori in the use of digital technologies, and two United States initiatives to encourage digital-technology-related skill acquisition.

Cisco Networking Academy Program – Cisco systems (a company which makes networking equipment) has provided around \$50,000 for physical capital, instructor training and support, and web site development for this program in Te Kaha. The Academy programme is a joint initiative of Te Rūnanga o Whānau (the local iwi/hapu) and the Pacific Islands Matati E Fa Trust in Auckland. This programme not only provides training opportunities for local people, but also leaves the programme self-sufficient in its training provision (as local instructors are trained by Cisco). The payoff for Cisco is that trainees will be familiar with Cisco products. The payoff for trainees is that they will have nationally and internationally marketable computing skills, increasing their chances of employment in higher-paying occupations.

United States (transforming federal training) – a taskforce on the use of technology in relation to the training of federal government in the United States recently produced a set of recommendations, which were adopted by then-President Bill Clinton.⁴⁴ Among the recommendations made were:

- Establish a government fund for learning technology, since lack of funds for start-up costs were found to be a major impediment to technology-based learning systems.
- Launch a campaign to education decision-makers on the advantages of using learning technology

The project has yet to be evaluated.

United States (promoting IT careers) – a U.S. Department of Commerce study into the growing need for workers with specific IT skills suggested, among other things, that children could be encouraged to aim for IT careers by changing the image of technical professionals.⁴⁵ Proposals for doing this included:

- Developing national information and advertising campaigns to improve the image of the technical professions
- Encouraging technology-intensive companies to invite members of the community into their workplaces
- Promoting positive role models (popular TV characters who exhibited the desirable but not the undesirable traits of technical professionals were especially emphasised)

To our knowledge, the impact of these recommendations has yet to be evaluated.

⁴³ They are more likely to purchase it on behalf of a future employer or personally, as they are familiar with it and the cost of learning to use an alternative vendor's equipment may be high.

⁴⁴ Presidential Task Force on Federal Training Technology (2000), "Technology: Transforming Federal Training", July, http://www.technology-taskforce.gov/ftt_rpt.pdf.

⁴⁵ Meares, Carol Ann and John F. Sargent, Jr. (1999), "The Digital Workforce: Building Infotech Skills at the Speed of Innovation", US Department of Commerce.

Business growth

The benefits to a community of business growth include employment and (therefore) income growth. Longer-term effects of business growth may also incorporate greater management expertise in the community.

We argued above that government assistance to businesses can be difficult to justify, and that funding proposals should be evaluated on a case-by-case basis, with a strong bias for not interfering in the market.

Consistent with that view, there are few general government policies we can advocate here without deeper investigation. However, we do know that one reason technology-related businesses do not prosper in rural or semi-rural regions (where Māori are a significantly greater proportion of the population than elsewhere) is that broadband communications infrastructure is scarce.

In other countries, governments have decided to become actively involved in improving access to broadband communications infrastructure:⁴⁶

- Ireland is committing \$418 million over five years to subsidies extending broadband access to areas outside Dublin
- Singapore is contributing \$135 million to developing the Singapore-One broadband network
- Australia earmarked \$584 million from the sale of Telstra shares to be spent between 1997 and 2002 on enhancing telecommunications services in rural and disadvantaged areas.

To our knowledge, no evaluation of the benefits of this spending have yet been undertaken (as with many initiatives in this area, it is too early for such evaluations to be of much use).

In New Zealand, we are unaware of any government spending on broadband communications infrastructure which may promote business growth in rural regions. There are a number of general business assistance programmes aimed at promoting businesses of all sorts (WINZ Start Your Own Business programme, technology incubators receiving local government and private funding, etc.).

Social cohesion

Few initiatives to close the digital divide seem to be directly aimed at increasing social cohesion. However, because of the positive effect of computer use on education and employment, and because many computers promote networked communication, increased social interaction is often one result of programmes with other main aims (see for example, 2020 Communications (2000), *Op. Cit.*).

In the United States, one community computing exercise was aimed at increasing social cohesion. While the project involved making computers available in a deprived area, the main focus was building a database of community assets (human resources,

⁴⁶ Collins, Simon (2001), "Our Turn: High-Tech Learning to Increase Net Returns", New Zealand Herald Online, 3 July 2001, <http://www.nzherald.co.nz/storyprint.cfm?storyID=197981>.

businesses, capital equipment). By making participants more aware of the assets in their community, and by allowing participants to build the database themselves, the study's authors felt this strengthened not only the community's human and economic capital, but also its social capital.⁴⁷

Race-based policies

If ethnicity is not the reason for the digital divide (see above), then a non-race approach to its closure may be sensible, since other ethnic groups will also have the divide between them and the overall average closed at the same time. However, for some initiatives, it may be efficient to target initiatives at homogenous communities, for example Māori communities. One example would be the “computers in homes” scheme, which operates in Wellington and the central North Island.⁴⁸ This relies strongly on networks to perpetuate access and learning, and it seems to us that these networks are likely to be strongest in homogenous communities, although this may be an area for further research.

Weighing social cost against social benefit

In the previous section, we identified the costs and positive effects of a number of initiatives, but we have not explicitly weighed costs against benefits.

Our findings have been necessarily qualitative because little quantitative research has been done in this area, at least in New Zealand. This is partly owing to the fact that widespread use of digital technology is a recent phenomenon.

Even where research has been done (such as on the benefits of computer aided education in the United States) the variables which have been measured have often not been in the same units as the inputs (usually dollars), making genuine cost-benefit comparisons difficult. Furthermore, the rapidly evolving nature of the technology means the costs and benefits are constantly changing, rapidly invalidating previous work in this area.

In our view, the uncertain nature of costs and benefits provide an argument against closing the digital divide with public money – uncertainty means higher risk.

We have provided some suggestions for initiatives in the recommendations that follow below, basing these on schemes that seem to have been successful in the past. However, given the lack of hard data on past performance, we also suggest that further cost-benefit analysis of specific policy proposals should be undertaken. Such analysis is beyond the scope of this general paper.

Conclusions

There is statistical evidence that some groups of New Zealanders have no ready access to the digital technologies which have been, and will apparently continue to be, a driving force for economic growth.

⁴⁷ Turner and Pinkett (2000), *Op. Cit.*

⁴⁸ 2020 Communications (2000), *Op. Cit.*

One such group is Māori, and although some Māori have better access than others, a *digital divide* exists between Māori and other ethnic groups.

This divide between Māori and others is not solely due to race, but evidence from overseas suggests that ethnicity may play a weak role in use of digital technology. In any case, Māori are over-represented in those sectors of the population with low access to, and use of, digital technologies.

There is evidence that the effects of this divide include:

- Reduced educational achievement
- Reduced opportunities for employment
- Reduced opportunities for business development
- Reduced participation in the democratic process

Closing the digital divide is a necessary but not sufficient step in increasing Māori employment, incomes and business activity. Other skill development initiatives, and perhaps policy initiatives in other areas, will also be required.

This begs the question – is it the digital divide, or other divides, we want to close? The most efficient way to closing the gap between the incomes of Māori and other New Zealanders, for example, may involve changes in general education rather than the explicit use of digital technology.

Assuming that the digital divide is the one we want to close, some policies aimed at achieving this goal are likely to be less costly than others.

To assess the likely success of initiatives, there are some general policy principles to consider:

- Initiatives should be in accord with the preferences of locals, and if possible, in accord with the preferences of those ultimately providing funding
- Initiatives should target market failures, such as externalities (suggesting initiatives based around education are a good idea)
- In addition to the direct cost of initiatives, their opportunity cost should be considered. “Opportunity cost” is the return from alternative uses of funding.

The cost of initiatives to close the digital divide can be quite low (in the case of some education initiatives) or quite high (in the case of some business assistance or specific training initiatives). Costs may be reduced by seeking assistance from technology vendors (who benefit from having people use their equipment early in their careers), or by using recycled or free hardware or software.

Some studies here and overseas have evaluated the benefits of initiatives to increase the use of digital technologies in certain communities. However, because of the rapid advancement of technology and the recent introduction of many programmes, these evaluations rapidly become obsolete. Nevertheless, there appear to be robust findings that:

- The use of computers in education is beneficial, provided they are used in combination with traditional teaching methods. Computer and Internet use promote learning across a range of subjects.

- A positive side-effect of a number of initiatives has been increased intra- and inter-community communication, promoting “social cohesion”.

Of the programmes we have considered here, there has been little or no ex-post evaluation of programmes aimed at:

- Increasing participation in IT-related occupations
- Increasing the growth of technology businesses
- Increasing infrastructure development

This is largely due to the recent introduction of these programmes. The uncertainty surrounding returns from such programmes is, in our view, an argument against spending public money on them. Exceptions to the rule should be considered on a case by case basis.

In conclusion, the role for State intervention in closing the digital divide is more limited than a cursory investigation might suggest. If New Zealanders want Māori incomes to rise to the level of the average, it is important that Māori access to digital technologies is improved. But the digital divide should only be closed if Māori want it to be, and are prevented from closing it themselves. And the goal must be clear – if high incomes are what we are ultimately interested in, closing the digital divide might be less effective than more education.

Recommendations for government policies which could most effectively encourage Māori participation in IT

We stated at the outset that this paper was not meant to be an academic treatise, but was rather meant to stimulate discussion on the issue of a digital divide based on ethnicity. As such, the recommendations that follow should be regarded as fluid.

- The aim of closing the digital divide needs to be made clear. If the aim is to increase incomes, then closing the digital divide is not the only means to this end.
- Policies aimed at directly closing the digital divide through training or provision of physical capital should go hand in hand with policies to ensure that people are able to make free choices (this means the welfare system and impediments to migration should be taken into account)
- Skill development should be favoured over physical capital investment, although there may be a role for some central co-ordination of physical capital initiatives. Physical capital investment requirements may be part-funded by the private sector, or reduced by using low-cost recycled alternatives.
- One-size-fits-all is likely to be ineffective. Grass-roots initiatives are likely to solve this problem, and may decrease the level of subsidy required to close the digital divide
- Literacy is a prerequisite for self-directed, higher-level computer use! Programmes to ensure functional literacy will create large positive externalities, although these may take some time to appear
- Extending access to digital technologies in schools is likely to improve education outcomes, particularly for the most disadvantaged students. Most of our findings suggest that spending on general education will be a good strategy. The first tranche of any spending on hardware and training might best be directed at this sector.