Taking a Punt on Broadband: Regional Initiatives in New Zealand

J. Toland
janet.toland@vuw.ac.nz

Pak Yoong
School of Information Management Victoria University of Wellington Wellington New Zealand, pak.yoong@vuw.ac.nz

Follow this and additional works at: http://aisel.aisnet.org/ecis2007

Recommended Citation
http://aisel.aisnet.org/ecis2007/36
This paper will discuss recent initiatives to encourage the development of broadband networks in New Zealand. It is widely believed that the availability of good quality broadband will lead to improved economic development at the regional level. This paper considers the role played by both national and regional government in improving access to broadband. At a national level the government has developed a Digital Strategy, and has funded a project to make broadband available in rural regions of New Zealand. At the regional level, local government has also been active in setting up broadband networks for their communities. Two contrasting regions of New Zealand have been selected as case studies: one is a remote rural region; the other is on the periphery of a large city. The paper will assess these two cases and identify factors that contribute to successful community broadband developments in regional areas. The contribution that broadband has made to economic and social development in these two regions will also be discussed.

Keywords: Broadband, New Zealand, Regional government, Economic development, Social development
1 INTRODUCTION

The extraordinary level of interest in broadband among nations globally is due to the belief that broadband will bring social and economic benefits. Benefits are generally achieved by increasing profits due to expanding markets, or driving down costs through improved efficiencies. Applications typically cited include teleworking, tourism, entertainment, health and education. Possibly due to the difficulties in measuring the benefits of broadband, policy debate has focused on how to achieve high rates of uptake, rather than on whether that uptake is really in the interest of the society and economy (Firth & Mellor, 2005; Howell, 2003; Kelly et al., 2003; NSC, 2004).

Many countries worldwide have been pushing broadband, some of these initiatives are at the national level others are at a regional or state level. Often broadband is seen as a way of bringing opportunities for economic development to more remote areas. One criticism of many of these initiatives is that they are based on a “push” rather than a “pull” approach, with the emphasis being on building up infrastructure without stimulating demand (Heeks, 2005; Smith, 2005). The counter argument is that rolling out broadband is similar to building a good transport infrastructure, and the fact that it will bring benefits is taken as a given (Adams, 2005). To date little data has been collected to provide any proof that broadband is delivering the benefits claimed.

Despite leading levels of internet uptake and usage when compared to other OECD countries, New Zealand lies well to the bottom half of the OECD in respect of uptake of broadband technologies per capita. Public awareness of this problem is high; at a 2005 conference (Prendegast, 2005; Brash, 2005; Wilde, 2005) local mayors past and present stressed that the two critical factors for regional economic growth were a good international airport and a sound broadband infrastructure. All were clear that broadband rollout could never be justified on economic grounds alone, and that it is necessary for local councils to “take a punt”, as any region that stands back and waits for a clear economic case to emerge is likely to be left behind. David Cunliffe the current Minister of ICT stated that:

“For us not to have fast, ubiquitous broadband in New Zealand is competitive suicide” (Cunliffe, 2005).

This paper reports on a qualitative research project that assesses the impact of broadband on regional development in New Zealand. A number of initiatives have been put in place to increase the availability of broadband in New Zealand. At the national level the government has developed a Digital Strategy, and has funded the roll out of broadband to all schools in the country. At the regional level there has also been a lot of activity around developing community broadband networks. Two contrasting case studies of regional broadband developments will be discussed; one is in a rural area, the other on the urban periphery.

2 BACKGROUND

The setting for this research is regional New Zealand. New Zealand’s ICT infrastructure is relatively strong, with high rates of internet access, ICT penetration and electronic commerce (NZGovernment, 2002). New Zealanders have a very high rate of engagement with new technology, however as

---

1 To gamble

2 The Digital Strategy is an initiative of the New Zealand government to create a digital future for all New Zealanders, using ICT. It sets out a 5 year plan, and includes targeted funding for developing ICT infrastructure.
previously mentioned take up of broadband has been slow, and this has been identified as a cause for concern by both national and local government.

New Zealand is similar in size to the United Kingdom, but the population is only slightly over 4 million. Most of the population live in New Zealand’s five main cities, with only 14% of the population living in rural areas. The physical geography of New Zealand is dominated by mountain ranges and hill country which pose challenges in terms of developing full telecommunications coverage of the entire country (Locke, 2005). New Zealand is not the only country with a small dispersed population, this characteristic is shared with countries like Finland & Norway, but New Zealand’s lack of critical mass in terms of market size is compounded by remoteness from key markets and business networks. The hope is that broadband will help to overcome the internal and external barriers to trade faced by New Zealand, thereby, improving economic performance (Nischalke & Schollmann, 2005).

2.1 The Regions of New Zealand

![Regions of New Zealand](http://www.stats.govt.nz)

Figure 1. Regions of New Zealand (source http://www.stats.govt.nz)

For administration purposes New Zealand is divided up into 12 regional and 4 unitary councils as shown in Figure 1. Each regional council contains a number of territorial authorities; Figure 2 shows how the Wellington area is one regional council made up of 8 territorial authorities. Planning broadband infrastructure is generally the responsibility of the territorial local authorities; it is common practice for local authorities work together to achieve economies of scale when negotiating with telecommunications providers.
2.2 Digital Strategy

The New Zealand government has implemented several initiatives to help develop a knowledge society, encourage innovation, build up regional economic development, and improve usage and access to ICT. The most important of these is the Growth and Innovation Framework, which aims to enhance the existing innovation framework, develop people’s innovation skills, increase global connectedness, and focus initiatives in areas which can have maximum impact (NZGovernment, 2002). Increasing and improving the use of ICT is a key part of this initiative.

The Digital Strategy was launched in 2005 as part of this overall drive to create a knowledge society. The three main goals are to: enable effective use of ICT by communities; encourage innovation by business; and to improve government service (NZGovernment, 2005). One of the outcomes of the Digital Strategy is the setting up of two funds to which interested parties can put in bids for broadband related projects. These funds are part of two inter-related development programmes, one for urban and metropolitan networks, and another for remote and under-served communities. Seed funding is available to enable the development of open access broadband networks by sustainable partnerships. Figure 3 shows how the goals of the Digital Strategy are to develop New Zealand appropriate content, to build confidence, and to improve connection. The goal which is of particular relevance to this research is connection, which has the overarching aim of moving New Zealand up into the top quarter rating of the OECD for broadband uptake by 2010.
2.3 Project Probe

Within individual countries there is typically a marked variation between rural and urban areas both in terms of access to available telecommunications infrastructure and uptake by citizens (Parker, 2000). In general, the more remote the location and the smaller the population density, the lower the rate of participation will be. The concern is that uneven availability will increase the digital divide. A number of initiatives are currently in place to increase the uptake of broadband in New Zealand, and a major focus has been on ensuring that broadband is made available to isolated rural communities.

Project Probe (Provincial Broadband Extension Project) was a joint initiative of the Ministry of Education, and the Ministry of Economic Development to roll out broadband to rural areas, with a particular focus on schools. This project was completed in 2004, prior to the publication of the Digital strategy.

Building a broadband network is a long term project. The economic benefits of ICT networks often don’t show up until 20 years down the track, making it unrealistic for private investors to put up money for infrastructure. Outside of densely populated urban areas, it is generally agreed that some involvement of local or national government to build ICT infrastructure is necessary (AECC & Partners, 2004; Zilber et al., 2005). Project Probe aimed to close the broadband gap between urban and rural New Zealand and had two parallel objectives: to make broadband available to every school in the country; and to get broadband out to as much of the wider community as possible (iStart, 2004). The government divided up the country into 14 regions which roughly equated to the regional government structure shown as Figure 1, with the addition of a 15th region to provide satellite access to the most remote areas of the country. The contracts for each region were put out to tender. The telecommunication networks in New Zealand are owned and operated by the private sector, however the local loop at that time was still owned by the incumbent provider Telecom which eventually ended up winning the majority of tenders. It should be noted that the money provided for Probe was for set up only, there is no ongoing funding, and the only exception to this is a subsidy for those schools where satellite access is the only option.

At the beginning of Probe there were 2,700 schools and 900 of these were not able to receive broadband. Now broadband is available to all schools and as of 2006 approximately 50% of them have taken up the option of having a broadband connection (SSC, 2006). One of the results of Probe is that broadband access is now available to all towns, even the small ones, and in the rural areas there is now 50% coverage. Though all schools now have the potential to access broadband, it is still up to each school to decide whether they have the financial and human resources to make getting connected worthwhile. As of 2006 it was estimated that approximately half of all schools had linked up.

The main emphasis of Probe was on education, but it was expected that the availability of nationwide broadband would benefit regional businesses and would also lead to improvements in other government services such as health, policing, social services and conservation. The hope was that as broadband access was made available to schools in rural areas, local businesses would pick up on the opportunity and adopt broadband themselves. Though there are some success stories there are still difficulties in getting people, particularly those rural areas to recognise the potential of the internet (Locke, 2005). Though Project Probe provided broadband access to all rural areas, uptake has been patchy, and variations in uptake across the country mean that the network is not as efficient as if there was 100% coverage. The issue now is making rural communities aware of what can be achieved with quality internet access; however there are a lack of applications which are of direct benefit to rural customers. The extra funding made available through the Digital Strategy is intended to stimulate the development of these applications. It should also be noted that few new businesses in local areas have come about as the result of the availability of a broadband connection. It is hard to convince geographically spread small businesses of the advantages of using ICTs to connect when they see time taken to learn ICT skills as time away from the tools.
3 RESEARCH METHODOLOGY

The central research question is:

*How can broadband enhance the efforts of regions to improve economic and social development?*

This research uses a case study methodology which is considered to be useful when a phenomenon is broad and complex and it cannot easily be studied outside the context in which it occurs (Yin, 1984). The research used a multiple case study approach, two contrasting cases were selected to enable cross case analysis. Region A is a remote rural area, and Region B is an urban area on the periphery of a major New Zealand city. The research was carried out during 2006. Data was collected by a range of means, in depth, semi structured interviews were carried out with informants, who were identified as key figures in the adoption of ICT networks. The interview questions addressed a common set of themes including availability of infrastructure, the extent of linkages between local organisations, regional culture, commitment to learning within the region, and the adoption of innovative ideas. The interviewees worked for a range of organisations including local councils, telecommunications providers, schools, and community groups. Some of the interviewees had a regional focus; other interviewees had a national focus. In addition to the interviews further documentary evidence such as reports, survey results, statistics and web pages were collected as supporting data. Attendance at three New Zealand practitioner focussed conferences3, also provided much relevant material in which to frame the interview data. The most significant driver of broadband adoption in Region A was the local economic development agency which will be referred to as Economic Development Agency A; in Region B adoption was focussed around the setting up of a community telecommunications company which will be referred to as Community Telco B.

4 REGIONAL INITIATIVES

Local government in New Zealand regards the setting up of telecommunications networks as a form of infrastructure development similar to building roads, railway networks or a sewage system. As previously mentioned setting up a broadband network is often compared to building a road, with the applications that will run on the network being compared to the trucks that will run on the road. The following sections provide a brief overview of the development and impact of broadband infrastructure in the two regions selected as case studies. Some common themes emerged such as: frustration with inadequate telecommunications infrastructure forming the initial trigger to develop broadband; a problematic relationship with the National Government which provides assistance with start up funding, but is less keen to give ongoing support; providing broadband access to the whole of the community was also a critical issue for both regions. Other factors were unique to a particular region; in Region A a major driver for broadband was the desire to develop videoconferencing in rural schools, whereas in region B the setting up of a community telecommunications provider that combined public and private funding was an important issue.

4.1 Rural Region A

Region A is a rural area located in the South Island of New Zealand. The region received funding from Project Probe to contract a telecommunications provider to install a portable broadband network that

---

3 Digital Cities and Regional Networks, 23 November 2005, Wellington, NZ
TUANZ Rural Broadband Symposium, 29-31 March 2006, Timaru, NZ
ICT in the Workplace and Communities, 28 April 2006, Wellington, NZ
will be available to 90% of the population in the region. The eventual aim is to establish universal connectedness. The hope is that this will create jobs particularly in the regions core industries of farming and tourism. The policy has been to connect the whole region not just the metropolitan areas, and there has been a deliberate focus on outlying areas (NZTE, 2005). The portable broadband option has been particularly important for organisations in these more remote areas, which often don’t have the option to connect via landlines like ADSL.

Support for a regionally based telecommunications provider came out of unhappiness with existing services. An important factor in justifying regional development was persuading the national government organisations located in the region to contract in to the regional network. To date the major use of the regional broadband network has been videoconferencing in the education sector; however the availability of broadband also offers opportunities for the farming and tourism sectors. Achieving full regional coverage is also an important issue. These points are discussed in more detail in the following sub sections.

4.1.1 Initial Trigger

The driver behind the development of the broadband network was the Economic Development Agency A. This was set up by three local authorities to look at growing enterprise in the region, as well as being responsible for community development. The agency became aware of increasing dissatisfaction with telecommunication services within the region and in 2001 commissioned a comprehensive survey of the health, education, farming, tourism and residential sectors to assess existing and future telecommunications requirements (OSBCC, 2001).

4.1.2 Relationship with National Government

However one thing that became apparent at an early stage was that if you looked at just the local business, the local traffic, the local use of the internet, there was insufficient activity to justify regional investment. One potential solution was to persuade the national government to offer the region part of its business at a regional level, rather than contracting services vertically throughout the country. One interviewee explained the significance of the Economic Development Agency managing to persuade national government to do this:

“So that was quite a paradigm shift from the government state sector perspective to offer those services at a regional level as part of a demand aggregation. The theory was that if you could offer a slice of the government financial activity at a regional level then you could make investment possible in a region like A”

This all happened prior to Project Probe, so that when the opportunity for funding came along, Region A was able to mobilise quickly to take advantage of the opportunity

4.1.3 Videoconferencing

One of the major drivers for the Probe rollout was the potential benefits that videoconferencing could bring particularly to rural schools, in terms of sharing teacher resources and being able to offer a wider range of subjects for older pupils. In rural areas like Region A the use of videoconferencing has had a positive impact. In the past senior secondary school students faced a choice between leaving school early to take up a low skilled job or going away to boarding school. Now more young people are staying on at school due to the wider range of options, and as a result more are planning to go on to University. However it is still up to each individual school to set up videoconferencing; the purchasing and installation of equipment and cabling needs to be done by the school. A videoconferencing system that has to hold the attention of 20 or 30 schoolchildren needs to be high quality. Setting up a network is a significant undertaking, as one interviewee commented, “It’s not just something the local Dads can do”. This means that it’s the bigger schools with more resources that tend to install
videoconferencing. However one interviewee thought that in some cases smaller communities could be more successful in finding the resources to set up videoconferences as they had more community spirit. A good example of this is in Region A itself, where a local trust contributed $1.5 million to install 120 interactive whiteboards in local schools. The whiteboards were seen very much as a resource that could be used by the whole of the community not just the schools.

Many interviewees talked about the limitations of videoconferencing, a typical comment was,

“It’s really useful for the first twenty seconds, and after that really, unless you are doing something on a whiteboard or you are showing some content, then it’s pretty much a waste of bandwidth as well as looking shiftly”.

It is a big effort for a rural school to set up videoconferencing, even where videoconferencing was available it was often not used because of the effort required to co-ordinate meetings. An example was cited from the health sector where a video link between two hospitals in Region A was rarely used as it was hard to organise, and the room was at the end of a long corridor, most of the time it was more effective for medical staff to simply pick up a phone. This resulted in ongoing cynicism about the usefulness of videoconferencing from the health sector in Region A.

4.1.4 100% Coverage

For small rural communities not being connected to the internet means that for them the digital divide is widening. This doesn’t just affect the rural communities themselves, in a communications network if one person isn’t connected everyone suffers. This point is illustrated in an anecdote told by one interviewee about what happened in the 1990s when New Zealand Post decided to charge for rural deliveries. The reaction of the farmers was to tell New Zealand Post to “Get stuffed”, and cancel their deliveries. Initially only the farmers themselves were disadvantaged, but when the 20th of the next month came around all the businesses in town needed to post out invoices to the farmers and they couldn’t do it. So New Zealand Post quickly got the message not just from the farmers, but also from the townsfolk.

4.1.5 Future Developments

As of 2006, most activity around broadband in Region A has been in the education sector; however the availability of good quality broadband also opens up opportunities for other sectors of the rural economy. Potential applications for farming are weather monitoring, obtaining real time on farm production statistics, and offering farmers the opportunity to show high quality images of their products to potential buyers. In the tourism sector high quality web sites can be developed enabling local operators to attract the increasing numbers of tourists who are booking via the internet. It also allows tourism operators to showcase some of their ventures, for example, brown trout fishing. Local exporters should be able to reach directly into overseas markets, such as Australia. Local business will also be able to bring in external skills using telecommunications.

4.2 Urban Region B

Region B consists of three local authorities which are just outside a major city. The three areas cover a wide range of different socio-economic groups; there are areas of deprivation, but also some high income areas. Most of Region B would be classed as suburban, but some areas are rural and not well

4 National provider of postal services
served in terms of infrastructure. Areas just outside the major urban centres such as Region B complain they fall between two stools, while lacking the private investment to develop broadband networks enjoyed by the major cities; they are not remote enough to qualify for national government top up funding. The Region B area is just outside a large city, and suburban schools in the area feel that they were badly served by Project Probe; they don’t have access to the fast broadband networks in the main urban centres, but are not sufficiently “rural” to qualify for Probe funding. Access to affordable broadband is still a major issue for these suburban schools.

As in Region A the inadequacies of existing telecommunication services was the driver for developing a regional solution. With no funding available from Project Probe the solution was to set up a community telecommunications provider with a mixture of public and private funding. The issue of national public sector organisations choosing not to opt into the regional network is an issue that casts a cloud over the long term sustainability of community based telecommunications. The importance of achieving 100% coverage is also important. These issues are discussed more fully in the following sub sections.

4.2.1 Initial Trigger

Like Region B the initial decision to investigate setting up a community broadband network was prompted by dissatisfaction with the pricing and quality of existing telecommunications services. Also as in Region A a survey was carried out to gather the views of the local community. In 2002 three local authorities collaborated to send out a questionnaire to local businesses ascertain the demand for broadband, the results indicated that there was strong interest in pooling telecommunications spending in order to negotiate a better deal. A working party was formed to investigate the options, and the idea of pooling was eventually rejected in favour of an open access network, due to the fact that there was (at that time) no unbundled local loop, and the wholesale price offerings were high.

4.2.2 Establishing Community Telecommunications

The three local authorities set up an initiative known as Community Telco B. This is a new company, formed in 2004, with the objective of establishing an open, competitive, high bandwidth telecommunications infrastructure available to the communities and cities within Region B so as to create economic and social opportunities for local residents through community and global connectedness (Brash, 2005). Community Telco B has community shareholders, no one individual or body is allowed to hold more than 10% of the shares, the three city councils each have a 10% share as do private investors. The idea is that Community Telco B will be a provider rather than a supplier; it will set up an open network, that could potentially be used by many suppliers, with the aim of bringing down the costs of broadband, and bringing benefits to the local community. Community Telco B will form three loops around spectrum wireless, with wireless fingers radiating from each of the three centres. The hope is that the availability of broadband will stop the drift of businesses into the nearby major city, and provide opportunities for new applications such as teleworking.

To date few areas of New Zealand have actually managed to make community owned telecommunications work, especially where a mixture of public and private funding is involved. The funding for Community Telco B is start up funding only, and while it doesn’t need to make a profit it does need to break even. One common problem is that when incumbent providers get wind of a community based telecommunications initiative, they are likely to approach local residents with a cut price deal designed to undercut the local provider and win back business. It takes a strong commitment from the local population to put the long term interests of their region first and stick with the regional provider.
4.2.3 Relationship with National Government

One issue is that sectors such as education and health tend to be organised in silos, for example one company may cover all the telecommunication needs of the health providers in the South Island. This makes it difficult to persuade a local health provider to sign up to a regional network, as the key decision maker is located outside the region. As one interviewee commented,

“The biggest benefit that central government could bring to Community Telco B would be for the key central government departments located within the region to become clients of Community Telco B”.

Though the Digital Strategy makes funds available for regional broadband initiatives, these are all seed funds for a limited period of time, after which the initiative is supposed to become self financing. A more ongoing commitment by the national government would be to commit to becoming a major user of regional telecommunications itself.

4.2.4 100% Coverage

Developing a good telecommunications infrastructure was seen as a priority for both regions. The long term aim is to achieve 100% coverage taking the network out to even the most remote rural areas. Interviewees in both regions were clear that the reasons for developing a community owned telecommunications provider are not just about providing cheap telecommunications but are also about strengthening the community over the long term. As of 2006 Community Telco B had been successful in obtaining additional funding from the Digital strategy through the Remote and Under Served Communities category, this will enable it to extend the network out to the more rural parts of the region.

5 WILL THE PUNT PAY OFF?

Building a transport or telecommunications network is a large strategic project, so a common approach is for local councils to link up to form one shared regional vision: Economic Development Agency A looks after such projects for three local authorities in rural Region A; Community Telco B is also a joint initiative between three local councils in urban Region B. At the regional level community growth and economic growth go together, it is not simply about putting in place initiatives to help businesses make more money. At the national level the business sector and the community sector tend to be large professional organisations and there is little connection between the two sectors, however in a small town they are very connected. The same people who own the local dairy\(^5\) will also be running the Girl Guides. Both regions had a strong focus on the social benefits of building broadband infrastructure as well as the economic ones.

A telecommunications network differs from a gas or electricity network in that it is a communications network rather than a utility network. With a utility network if one person is not connected it affects only them, with a communications network if one person is not connected it disadvantages everyone else as well. The sender of a message may want to use the network to reach everybody in the region. This is why the goal of both regions is to get 100% coverage, even if it means taking a connection out to some really remote areas. Though it is expensive to push a telecommunications network out to rural areas, there was a broad agreement that it was a good thing to do. One interviewee used the road analogy;

“You don’t really know what people are going to do with the road after you build it, but you know intuitively that it’s a good thing to do”.

---

\(^5\) Local grocery store
However there is another school of thought, for example another interviewee in favour of the pull approach commented that there had been too much focus on building infrastructure, instead of building useful things to do with that infrastructure.

One issue faced by both regions is making community telecommunications break even after the start up funding runs out. Regional economies don’t often contain sufficient mass in terms of paying business customers to make building networks economically viable. A major help can be provided by national government organisations that are located in a region signing up to the local telecommunications provider. The presence of a community telecommunications within a region tends to produce competition from incumbent providers, this may reduce the cost of broadband in the short term, but it makes it more difficult for the regional telecommunications provider to survive long term.

To date, most of the demonstrable benefits of regional broadband networks have been in the education sector, in particular the use of videoconferencing and similar technologies to share teacher resources and provide more options for rural secondary school children. Local public sector organisations tend to become customers of community broadband networks before the private sector signs up. Surveys carried out in both regions showed a high demand for broadband from the private sector, but at present it is not possible to prove either that more new businesses have moved into the region, or that less businesses have left the region as a result of cheaper broadband being more widely available.

If looked at in terms of economic development, it would have to be said that the punt on broadband is showing some returns in the education sector, but in the business sector the expected results are a bit slower to arrive. However, in both regions, local government was clear that their reasons for building community telecommunication were broader than economic development alone. The social benefits that improved infrastructure brings to the local community are just as important as the economic ones. The benefits that broadband brings to health, education, community groups and individual residents may be difficult to put a dollar value on, but they are real, and make a major contribution to regional development.

6 CONCLUSION

Though pooling of regional resources creates a better environment for ICT investment, one issue is that the many of the social and economic benefits of ICT networks often don’t show up until 20 years down the track, making it almost impossible for investors to see any immediate returns. Some involvement of local or national government to build ICT infrastructure especially in remoter areas is required. There are also the social and cross organisational benefits that don’t come back directly to one particular investor. As one interviewee commented,

“We could provide all these services to Region C, where they’ve got a huge health problem. We know that the availability of these types of infrastructure and services will actually help people have a higher quality of life around health, and a whole bunch of areas. It’s never going to make a private investor any money, but the benefits are going to be from the Health Department being much more efficient in delivering services to people. It’s going to cost a lot less in managing the ailments these people have, and organising preventative care, so down the track it’s going to save a lot of money”.

Evidence from this research indicates that the New Zealand is right to take a punt on broadband, though the immediate pay out may be small, in the long term the widespread availability of high quality, affordable broadband will contribute to social and economic development in the regions.

6 Region C is a remote rural region
One of the limitations of the research was that time constraints meant that only a limited number of individuals could be interviewed from each region. The majority of interviewees selected were from local government as they were the main drivers in initiating broadband developments. However this meant that the views of other relevant sectors such as manufacturing, farming, tourism and education are under-represented. The research could be strengthened by either carrying out further interviews or conducting a survey with representatives from these sectors to gain a more complete picture of the actual and potential use of broadband within each region.

References
OSBCC, Otago Southland Broadband Communications Committee (2001) Blazing the trail to the information highway. Industry New Zealand, Invercargill.
S  

2196