The Potential Impact of Government Online Service Delivery on Rural and Remote Areas

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Abstract

Considerable attention is being given by governments throughout Australia and internationally to the use of information and communication technologies as a means of improving the delivery of government services. Enhanced communication capabilities are providing the prospect of distance-independent delivery of services, and particularly the capacity to improve the delivery to rural and remote locations. An emerging planning issue is whether the use of these technologies will result in significant reductions in the cost of service delivery to remote locations. This report provides an initial assessment of the evidence for this proposition. Many factors will influence the outcome of present efforts to use these technologies in service delivery. A range of initiatives was identified through a selection of case studies in the key areas of health, education, justice and whole-of-government services. The extent to which these initiatives, many in trial or early development stages, are likely to have systemic influence will depend on factors such as, the availability of technical infrastructure, the proving of their beneficial outcomes, the degree of effort applied by governments to support this diffusion, and the appropriateness of these developments to the organisational cultures of service provision. Despite the rapid changes in technology capabilities, extensive adoption in service delivery may still be a relatively slow process. A significant and established impact on service delivery is likely to take at least five years.

1. Introduction

This paper reports the result of an investigation into the proposition that the use of emerging Information and Communication Technologies (ICTs) is likely to result in significant reduction in the cost of provision of human services to rural and remote populations compared to traditional means.[1] It is an important examination given the gaps in service provision in rural Australia and the consideration by governments of the relative merits of different service delivery mechanisms.

We have taken the view that the first task is to gather the evidence of the feasibility of using ICTs in service delivery and secondly to draw together evidence or judgment on the cost effectiveness of this. We suggest that developments that are likely to have significant effect on service provision in the next five to ten years should be reasonably visible, at least in trial form, now. We seek to draw conclusions on the likelihood of widespread service provision occurring within this timeframe.

Case studies from Australia and the United States (US) are provided to indicate the range and extent of service provision in the key areas of service comprising:

- health;
- education;
- justice; and
- whole-of-government service delivery.

Examples are chosen for their applicability to rural and remote settings and, where possible, for their demonstration of integration into service systems. The US examples are included because of the relatively high development of applications in some areas, and the existence of state based approaches to service provision using ICTs. Evidence of associated costs and benefits in the key service areas are then examined.

In the context of these case studies, we examine the availability of infrastructure that is essential to the provision of services using ICTs, in section 4.

To evaluate the likelihood of significant implementation occurring in ICT based service provision within a specific time frame, we identify three key issues that will shape this outcome in section 5. These are:

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[1] CIRCIT (1996) *An Assessment of the Potential Impact of Information Technology and Telecommunications on Government Service Delivery for Dispersed Populations in the Period to 2005*, CIRCIT, Melbourne.

- the policy and program support for the utilisation of ICTs;
- developments in pricing; and
- organisational and human factor issues.

2. Current Developments in Utilising ICTs in Service Provision

The following ICT applications taken from Australia and the United States are indicative of the ICT based activity in the key service areas of health, education, justice and whole-of-government service delivery. They provide evidence of the widespread interest in applying ICTs and illustrate their potential to improve access to a range of services. ICTs may reduce the twin barriers of distance and isolation. They are radically altering the concepts of distance and space and rendering them meaningless. Examples were chosen because of their relevance to rural and remote regions; and the demonstration of a systemic approach across key application areas.

2.1 Health

The health care systems in the United States and Australia are increasingly required to demonstrate greater cost effectiveness and improvements in health care delivery. Health care providers are looking at alternatives to existing health care services, particularly in rural regions where gaps in health service are forcing patients to seek urban care.[2] Experts are becoming more specialised and are often geographically dispersed; geographic distance limits the access to health care providers and rural economies cannot support a comprehensive health care system.

Telehealth has the potential to provide a greater range of service delivery methods and improve access to medical and health related information. The use of ICTs in health care is being expanded, yet their use is 'seen more as a potential rather than an actuality by rural health providers'.[3]

In Australia numerous individual pilot projects have been undertaken to assess the technical feasibility of a range of services. The viability of these projects has led to the development of more extensive telehealth initiatives and there are approximately 150 telehealth sites in Australia, yet few of these provide systemic service delivery.

Key areas of service provision in healthcare are:

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2 PHRCIT (1996) *Telehealth in Rural and Remote Australia*, Monash University, Melbourne, identified four major gaps in rural health care: mental health & psychiatry; allied health services; alcohol & drug services; and specialist medical services.

- clinical consultation and diagnosis;
- telepsychiatry and counselling services;
- health information management; and
- professional development.

Clinical Consultation & Diagnosis

Consultation between practitioners can be enhanced through e-mail facilities, with referrals and patient information transferred in a timely manner to referring doctors. Videoconferencing also provides important opportunities for consultation, seeking specialist advice and patient diagnosis through diagnostic imaging, the transmission of high quality body tissue and organ images to a specialist doctor in a distant location.

The Metropolitan and Country Healthcare Network, links three urban Melbourne hospitals (St Vincent's, The Royal Victorian Eye and Ear, and The Royal Children's hospitals) and the Goulburn Valley Base Hospital. The network aims to improve the delivery of health care to rural patients by enabling patient assessments to occur at their local hospital via videoconferencing links to specialists in Melbourne. A Telstra broadband network will support the speedy transfer of specialist advice and diagnostic imaging between rural and urban centres. The eight concurrent projects include the Slit Lamp Imagery Project, Children's Burns, Neuroscience's, Radiology, Cochlea Implant, Adult Psychiatry and the Intensive Care Unit Case Management Education Project.

The Queen Elizabeth Hospital Renal Dialysis TeleMedicine Project (South Australia) established four satellite dialysis sites in South Australia. Woodville, Wayville, North Adelaide and Port Augusta, (which is 300 kilometres away) were provided with telehealth facilities to evaluate its use in enhancing the delivery of renal health care and professional development. Each site was connected by Integrated Services Digital Network (ISDN) to the Queen Elizabeth Hospital in Adelaide and supplied with videoconferencing technology, including a portable desktop unit, which can be moved from patient to patient. A total of 145 patients are dialysed at these sites, and another 29 patients use the dialyses at home.

Various clinical staff including doctors, nurses, pharmacists, dietitians and others, use the network to communicate with patients and each other. Videoconferencing facilities enable remote face to face communication, necessary for consultation and diagnosis; confidentiality

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3 PHRCIT (1996) Ibid: 2.

is supported through the use of headphones. The network is also used for instructions, tutoring and administrative purposes. Evaluation of the project demonstrates the acceptance of telehealth facilities by staff and patients and highlights the role of induction, training and clinical support in the high adoption rate of the service.[4] In a three-month period the telehealth facility was used 1150 times - equivalent to 400 times per month.

Telepsychiatry

After demonstrating improved patient management in a series of telepsychiatry pilots and trials, The *South Australian Health Commission* (SAHC) established a Telemedicine Unit in 1995.[5] It operates as part of the mainstream mental health services. The Unit aims to promote mental health services in rural and regional South Australia by providing videoconferencing services for psychiatric assessments and consultations, and for liaison between family members, health care practitioners and patients. There are currently 16 telepsychiatry centres in regional and rural South Australia and videoconferencing links in Darwin that facilitate the supervision of psychiatric trainees.

Current evaluations of the South Australian Health Commission demonstrate the level of clinical and patient satisfaction with the telehealth program.[6] This project highlighted the capabilities of the technology, the critical role of clinical support and the resultant improvement in patient management.

Health Information Management

Telehealth networks can be used to improve co-ordination and administration of health information. Common usage includes billing services, patient admissions, discharge and transfer services and the co-ordination of services amongst health care providers in a region or regions.

The *Queensland Telemedicine Network (QTN)* was established to provide overall co-ordination of current and future telehealth applications. It is developing protocol and policy standards to ensure integrity across the range of applications. It is implementing the Queensland Telemedicine Information Exchange, which will provide avenues for analysis of existing telehealth applications.

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4 Mitchell J & B. Mitchell (1995) Establishing Renal Clinical Telemedicine: An Evaluation of the Queen Elizabeth Hospital Renal Dialysis Telehealth Project 1994-1995, http://192.131.13.10/jma/tqehrep.htm

5 Kavanagh,S & Yellowlees, P (1995) 'Telemedicine-Clinical Applications in Mental Health' *Australian Family Physician,* Vol.24 No.7:1242-1246.

6 Kavanagh, S & Yellowlees P (1995) *Op Cit.*

QTN assesses proposed projects and provides grants for applicants that demonstrate usefulness. It will facilitate the development of six new initiatives each year and evaluate initiatives. Analysis of evaluations will examine user satisfaction and the effect on patient outcomes including access, equity and cost effectiveness aspects[7].

Wisconsin Health Information Network has established a secure line link between hospitals, laboratories, insurance firms and other health care agencies in Wisconsin. The network consists of ISDN, frame relay services, leased lines and the WHIN software. It is used for the transfer of patient records, patient billing systems, full Internet access and other information. There are currently 3241 participants at 240 operational sites, including 17 hospitals throughout the state of Wisconsin and expansion to all hospitals is planned. WHIN recently contracted MedVision (a software company) to deliver telehealth applications including videoconferencing facilities.

Professional Development

There is a shortage of health practitioners in many rural and remote regions. The isolation from peers, lack of adequate specialist advice and insufficient exposure to accessible professional development programs is implicated in this shortage. Telehealth applications can support existing professional development activities by providing low cost, local access to professional development networks, training and support.

The *HealthNet* service at Health Sciences Centre at Texas Tech University is considered to be a national model for the delivery of rural health care services. Its coverage includes 340 000 square km, or 50 percent of the state, much of which is rural. The HealthNet facility includes a variety of services and applications that address the needs of rural health care practitioners. 100 hospitals in Texas and New Mexico receive satellite broadcasts for continuing educational purposes, which reaches over 8700 health care practitioners. HealthNet has adopted a "Total Staff Development" approach, which allows participating staff to meet all their continuing medical education requirements.

These case studies canvass the widespread interest in telehealth applications in rural regions. They illustrate the capacity of ICTs to deliver health services; reduce the twin barriers of distance and isolation; and they allude to potential benefits for rural patients, practitioners and the wider health system.

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[7] Department of Psychiatry, University of Queensland. 1996, *Queensland Telemedicine Network*,http://psycho.herston.uq.edu.au

2.2 Education

Trial projects demonstrating the use of ICT in the educational sector have been prominent in the United States and in Australia. Australian states are beginning to incorporate ICT applications into broader programs for administration and educational strategies.

Activities of relevance to education in regional and remote areas can be identified by the kinds of applications involved, namely:

- Real-time Course Delivery;
- Remote Questioning, Work Transfer;
- Course material and Information Access; and
- Group Communication/Project Development.

Real -time Course Delivery

Real-time course delivery requires the simultaneous connection of two or more sites and usually a degree of interaction between them. Australian schools have had a range of experience in remote course delivery through innovative uses of audiographics/telematics with reliance on voice, fax and computer software such as Electronic Classroom. Recent developments from this experience have utilised electronic whiteboards and moved towards videoconferencing approaches.

NSW Open Training and Education Network (OTEN)[8] is a joint initiative of the New South Wales TAFE Commission and the New South Wales Department of School Education. It provides distance education and training programs to over 28,000 TAFE, workplace and school students in over 600 subjects. OTEN provides a range of learning resources and support services. It manages a TAFE-wide satellite network that is used for the delivery of live interactive television courses and update programs to TAFE students and industry, as well as using videoconferencing and audiographics where appropriate.

The *Georgia Statewide Academic and Medical System (GSAMS)* commenced in 1992. The network provides two way videoconferencing facilities for open learning students that can facilitate interactivity between eight sites at once. Programs include accredited courses, in for example, foreign languages, and journalism, adult learning classes, seminars and workshops on a wide range of topics. There are currently 300 open learning sites and 325 conferences are distributed each week to more than 900 locations. GSAMS is available in K-12 schools, colleges, universities, correctional institutions (9 sites) and other institutions. All

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[8] htttp//www.oltc.edu.au/olcs/case12.htm

sites can produce and receive information and a coordinator is given the responsibility for scheduling programs. Regular updates are distributed to keep participants informed of new course opportunities and events.

Remote Questioning, Work Transfer

Online services, particularly email, provide a facility for remote students to question teachers and transfer work for comment and correction which is now becoming imbedded in a range of distance education approaches. The Western Australian Schools of the Air approach illustrates and predates this general capability.

Western Australian Schools of the Air has provided computers and associated support to remote students for some years. In 1995 there were 110 modems, computers and software in the homes of remote learners throughout Western Australia. As an alternative to sending work materials and responses via mail truck, with the time for feedback possibly longer than a month, a data transfer trial was initiated by the Carnarvon School of the Air in 1991. Work materials are electronically transferred to a *HyperCard* application, with completed work being forwarded to a mailbox in a school bulletin board for teacher review and response.

Reducing the time between completion, review and return of work has had a positive impact on isolated students, with students generally producing more work than previously on paper. Training of teachers and support through computer co-ordinators has been emphasised for success of the program. Communication limitations have been experienced through the low speed modems on the Digital Radio Concentrator System used by students who are up to 700km from the nearest school.

Course material and Information Access

Experience with online information systems has been developing for some time. Development of the Internet, particularly the World Wide Web, now provides the potential for broadly based access of students at home and in institutions to course material and other information at their own pace. According to Palmieri et al (1996) while there is considerable activity in exploring the value of this medium, much of its use is still in its infancy. Web-based approaches are generally not directed particularly at regional or remote users; to the extent that there is effective Internet access they are ubiquitously available.

SOFWeb is a WWW site providing access to a range of educational resources for teachers, parents and students. It provides a directory of information, links to other Web sites, including for example Victorian Schools on the Web, and training opportunities. Its ‘Learning on the Internet’ pages provides basic training in email, publishing on the Internet,

research and collaborative projects. As part of its Classrooms of the Future program, the Directorate of Schools Education created the site.

AskERIC is the on-line information service of the Educational Resources Information Centre (ERIC), which forms the Department of Education's national education information network. The service provides users with a question-answering service, whereby people can email educational-related questions, and receive a response from a network subject specialist within 48 hours, based on ERIC database searches, ERIC subject digests and Internet resources. The service draws on material from 16 subject-specific information clearinghouses. Users can also gain access to AskERIC's 'virtual library' on the World Wide Web, wherein they can browse through and download from a collection encompassing 600 lesson plans, and 60 InfoGuides, which provide directions to list-servs, publications and assorted Internet resources on a variety of educational topics.

Group Communication/Project Development

Various Internet services provide the opportunity for group communication and collaborative project development and have strong school usage.

I*EARN is a non-profit, international organisation with member schools across more than 30 countries. I*EARN provides its members with both an online and printed directory of all schools in the worldwide network. One of its principal aims is to encourage students and teachers to collaborate on activities, such as the AQUA water-monitoring project. I*EARN (1997) currently has more than 30 structured projects in social studies, science, the arts and interdisciplinary subjects for member schools to elect to take part in.

Evidence of the effective use of ICTs in service provision within the education sector is highlighted by these case studies. There is some evidence of the integration of previously isolated applications, which is indicative of a more systemic approach to ICTs in service provision. There is real potential to increase access to educational service for rural and remote communities using ICTs.

2.3 Justice

The use of ICT within Australia and America's respective justice systems (encompassing prisons, courts and the police), is characterised by the need to improve administrative procedures, effectively co-ordinate law enforcement information resources, and extend judicial services to sparsely populated or remote areas.

Online services are increasingly being used in the justice area to realise efficiencies by holding remote arraignment's, obtaining evidence from witnesses in remote locations, to conduct remote parole hearings and medical consultations for prisoners and for administrative activities.

Remote Trials

Courts Videoconferencing Trial. The Department of Justice has been trialing the use of videoconferencing in linking metropolitan and regional district Courts for the submission of evidence and professional communications. The videoconferencing network links the Melbourne Magistrates' and County Courts with the Moe and Mildura Courts, as well as the Police Forensic Science Laboratory at McLeod. It has been used for various court procedures, including remote witness hearings, pleas submissions, sentencing, remand hearings, administrative meetings, and pre-hearing conferences. Project personnel believe the network has represented significant savings in terms of costs involved in prisoner and witness transportation, as well as savings in travel time for expert witnesses (cost-benefit details will be addressed in a forthcoming evaluation). The service operates on the public ISDN network that, because it is based on an international technical standard, permits connectivity with other videoconferencing systems both interstate and overseas. Commencing operation in March 1996, the pilot study has recently been concluded, with a preliminary evaluation report tabled during January-February 1997.

Integrated Justice Networks

The Federal Bureau of Investigations (FBI) is to replace its existing National Crime Information Center, established in the late 1960s, with the *NCIC 2000* system. The new network will automate information handling procedures performed manually (eg. collection of benefits data), provide new services (eg. automated single-finger fingerprint matching) and extend access to internal and external electronic databases (eg. Convicted Person on Supervised Release). Existing NCIC terminals will eventually be replaced with a 386 personal computer, a flatbed scanner, livescan device, image printer and two-way radio equipment. The network will operate throughout the Bureau's Control Terminal Agencies, and will be accessible from Bureau patrol vehicles, which will be equipped with mobile display units, keyboard, one-finger livescan and image printers. Originally scheduled to commence operating in December 1995, implementation has been delayed due to requests for additional functions, such as delayed query and data extracts. NCIC 2000 is expected to be fully operational by Autumn 1999.

Videoconferencing and other ICTs are playing an increasingly important role in the delivery of justice to rural and remote populations. These examples highlight the applicability of ICTs in service provision.

2.4 Whole-of-Government

Federal and State Governments in the US and Australia (and some local governments) have expressed support for the development of regional, state and nationwide networks that facilitate the electronic delivery of government services, and provide a single point of access to whole-of-government services for the community.

The Australian Commonwealth Government Information Technology Review Group (1995) in its report *Clients First: The Challenge for Government Information Technology*, argued that the Commonwealth should undertake pilot projects of technologies that promote the "one-stop-shop" concept of service delivery, that would allow individuals to deal with multiple agencies from a single access point. The various state strategies resulting from such recommendations are aimed at "making information technology a more efficient and effective means of achieving the objectives of government" underpinned by a recognition of the potential for using ICT to generate savings in the delivery of government services, especially to sparsely populated and remote areas.

Most State and Territory governments have developed plans and strategies to implement whole-of-government wide area networks, which will advance the development of infrastructure within their regions well in advance of what might otherwise be the case, particularly in rural and remote regions. All States and Territories are also introducing a form of electronic service delivery to the public.

The ACT Government has completed trials of *AUSTOUCH*, a touchscreen kiosk system initially designed to provide access to local government information. Ten stand-alone kiosks have been in public use since January 1995, supplemented by an AUSTOUCH Web site launched in 1996. Both services currently provide consumer information about the roles of local government, agency services and public events. The kiosk system incorporates transaction, printing and ticketing capabilities which allow people to pay rates, land tax and parking and traffic fines.

Maryland Sailor Internet Network is Maryland's statewide 'freenet', which offers the general public dial-up and Web-based access to online government and community information resources. Sailor was launched in July 1994, initially using a 'Gopher' protocol for online file

storage and retrieval, and is shifting towards a completely World Wide Web-based system, which began with the creation of the Sailor Web site in June 1995. The project initially began as a means of linking the state's public libraries for resource sharing purposes, but has since grown to incorporate such initiatives as 'Maryland Electronic Capital' which is the central site for state government agency Web pages, which have been developed at the request of Maryland's Governor. Electronic resources are grouped under subject areas, such as 'Health & Medicine' and 'News & Reference'. Users can gain dial-up access to the network from their home or workplace computers, or use Internet access points installed in 21 of the state's 24 public libraries.

2.5 Summary of Activities in Utilising ICT Services

These activities in the key service areas of health, education, justice and whole of government service delivery, demonstrate the capacity to use ICTs in service provision in rural and remote communities. The case studies highlight the kinds of activities currently available and illustrate the potential benefits arising from their introduction, most notably greater parity with urban populations. There is ample evidence that rural and remote regions can be serviced by electronic means. However most of these activities are in trial phase and are isolated. Many of them have been championed by pioneers. They are not, in general, embedded within an existing service system. It is likely to take several more years for evidence of widespread integration. Examinations of those issues that will shape this outcome are discussed in section 3 and 4.

It is necessary to consider two other key factors that influence the proposition we are examining. These are:

- evidence of cost reductions; and
- the availability of infrastructure to support applications in key service areas.

3. Evidence of Costs and Benefits of ICTs

We sought to gather evidence or judgements on the cost effectiveness of ICT service provision. While there are numerous examples of the "business prospects" of what online services are intended to achieve, there is a general paucity of well documented evaluative material on the cost and benefits of government related ICT initiatives. One key problem is that many of the initiatives are still in their infancy and have not been operating long enough to be able to clearly evaluate the economic and social impacts. Another problem is that

evaluation has not been fully integrated into program design and development and many 'failures' have not been recorded.

This limits our ability to effectively evaluate the potential of ICTs to significantly reduce the costs of service provision to rural and remote populations. However, the following reviews provide some case study evidence from documented cost benefits of specific trials and studies. These reviews provide an indication of the types of cost and benefits of introducing new technology that we may start to see on a larger scale in 5 years time.

3.1 Telehealth

North Carolina Information Highway

Two telehealth trials in North Carolina, VISTANet and Medical Information Communications Application (MICA) demonstrate the power of a high bandwidth network when supporting telehealth applications. Based on the costs of early charges for leading edge technology and staff required to operate it, it was calculated that the North Carolina Information Highway (NCIH), an advanced ICT state wide network, could provide the public health system in North Carolina with over $US783, 000 in net benefits over the next eight years, by realising savings from additional productivity (ie. time spent on the job, $US2, 916.151), travel saved to meetings and training ($US4, 002,561), and money saved on paying substitute staff ($US343,077). However, the net benefits were calculated to be only about $783,000 over the same time period. Due to the innovative, leading edge infrastructure being used, the initial costs are high. Over time, as the infrastructure costs are distributed over many applications and services, the net benefits from the NCIH initiatives are expected to increase (NCIH, 1996).

Many other specific examples of cost savings achieved through telehealth can be identified:

The Medical College of Georgia found that 81 percent of patients seen over telehealth did not require transfer to a secondary or tertiary care centre. In Georgia the cost differential between rural and Medical College beds is $US800. In addition to that saving, telehealth allowed savings in transportation, increased productivity, and decreased hospitalisation days for treating a patient at an earlier stage. If rural hospitals were to retain telehealth patients, the increase of a single patient per day to the rural hospital census represents a net cash flow of $US150, 000 per year for the hospital.

In 1992 the Texas Tech University Health Sciences Centre commissioned an independent cost analysis of telehealth services used in its project. The costs of using telehealth services

with 11 randomly selected patients were compared to the costs that were likely to be incurred if telehealth were not available. An average saving of $US1500 per patient was reported. According to Moore (1992) most of the saving was due to the reduced cost of treating patients locally in a rural primary care centre (as opposed to an urban tertiary care centre) and to reduce need for emergency transport.

Other benefits are also documented. The benefits and savings of telehealth fall into both tangible and intangible areas for different stakeholder groups. The key benefits arising from telehealth for patients are:

- improved access to specialists and other health care professionals;
- improved quality of health care services; and
- reduction in unnecessary patient transfers and associated risks and costs.

The key benefits arising from the introduction of online services for health care practitioners are:

- wider range of service delivery options;
- increased diagnostic ability;
- increased access to professional development and support;
- reduction in unnecessary travel and associated risks and costs; and
- more efficient administrative procedures.

The key benefits to the health care system include:

- improved equity of access;
- reduction in transfer costs; and
- positions rural communities at the centre of care.

3.2 Education

While numerous examples of the widespread use of ICT in the education sector, particularly via the Internet, can be found in both Australia and overseas, finding documented cost/benefit evaluations has proven difficult. Anecdotal evidence suggests that the introduction of ICT has resulted in many savings in administrative costs, is leading to the restructuring of the way that education is being delivered, and has resulted in many more people being able to take advantage of education opportunities through distance education courses.

The US Advisory Council on the National Information Infrastructure (1995) developed four different costing models for connecting schools to the Information Superhighway (see Table 1). The Council calculated that to implement the “Classroom Model” across the nation by the

year 2005, one time purchase and installation expenditures would total approximately $US965 per student, while ongoing operations and maintenance expenditures would be over $US275 per student for the 10 year deployment period. The cost for the "Lab Model" would be $US225 and $US80 per student respectively over a five year deployment period. The Advisory Council found that to implement the most costly option of the Classroom Model would cost 3.9 percent of the education budget, the cheapest, the Lab Model, 1.5 percent. Currently expenditure on equivalent technology is already 1.3 percent of the national education budget. These costs have to be weighed against the potential cost saving measures which can be introduced as a result of ICT, such as administrative efficiencies, centralisation of multi-campus site administration, opportunities to raise extra revenue through providing distance education classes to the community and business and savings from carrying out distance in-service training etc.

While no formal attempts have been made in North Carolina to carry out rigorous cost benefit analysis of the distance education implementation, ICT has been able to realise large savings for individuals, especially in terms of accessing education and training courses from remote locations. For graduate education and learning the NCIH were able to demonstrate an average saving of $US1290 for a typical distance learning participant undertaking a local extension course offered by a university, and available through distance education at a local facility, compared with the cost of doing the course onsite at the university campus. For a single course the value to an individual was 3,000 fewer miles, 60 hours less driving time and $US1290 in direct savings. This figure represents savings for only one course. It places no value on indirect benefits such as increased safety, lower stress, or additional quality time the person can spend at their job or with their family.

The key benefits arising from the introduction of ICTs in the education arena for schools:

- equity, in enabling access to subjects otherwise not viable;
- positive impacts on attendance and discipline;
- avoidance of travel times (compared to a bussing alternative); and
- building relationships with distant students and schools.

Teachers:

- reduced travel time and expenses; and
- access to professional development not otherwise available.

Community:

- efficient use of sunk costs;
- building wider community relationships; and
- providing community services and information.

Table 1: Cost Models for Connecting Schools to the Information Superhighway

Model	Features	Estim. cost deploying & operating infrastructures in Public K-12 by 2005*
Features common to all models	• District server and LAN • School server(s), printers, scanners • Software, professional development and support	* As a reference point, current expenditures on equivalent technology are running at about 1.3% of the education budget
Lab Model	• Single room • computer • Ethernet LAN in lab • telephone lines	1.5%
Lab Plus Model	• Single room • computer • Ethernet LAN in lab • 10 telephone lines • 1 computer and modem per teacher	3.0%
Partial Classroom Model	• Half of classrooms have 1 computer per 5 students • Ethernet LAN across and within all classrooms • T-1 connection	3.4%
Classroom Model	• All classrooms have 1 computer per 5 students • Ethernet LAN across and within all classrooms • T-1 connection	3.9%

(Source: adapted from US Advisory Council on the National Information Infrastructure (1995), *Kickstart Initiative*)

3.3 Justice

ICT is increasingly being used in the justice area to realise efficiencies by holding remote arraignment's, obtaining evidence from witnesses in remote locations, parole hearings and medical consultations for prisoners. Emerging evidence suggests that ICT will make a significant impact on the ability to administer justice from a distance, and therefore service rural and remote communities.

In Victoria, the electronic data interchange (CEDI) service in the Magistrate's Court (civil jurisdiction), launched in 1994, has reduced the time for lodgement of civil court forms from four days to overnight. September 1996 figures showed that 34 percent of complaints and 18.5 percent of default payments were lodged through EDI. In the Victorian Courts

Videoconferencing Trial, which linked the Melbourne Magistrate's and County Courts with the rural Moe and Mildura Courts and the Police Forensic Laboratory at McLeod, project staff reported that the network represented significant savings in terms of costs involved in prisoner and witness transportation, as well as savings in travel time for expert witnesses (cost/benefits will be addressed in a forthcoming evaluation). The Victoria Police has also reported significant improvements in customer response times through the deployment of ICT and extensive business process re-engineering.

3.4 Government

There is increasing evidence world wide of ICT applications being used to streamline government operations and improve service delivery. There are four major ways in which governments are likely to use ICT services: to improve internal efficiencies; to enhance service delivery to external clients; to provide support for broader industry development; and to facilitate supporting broader utilisation of services by the wider community.

North Carolina provides one of the world's first attempts to carry out an evaluation of an advanced ICT statewide network. In 1996 the State Controller carried out an evaluation of NCIH in order to determine its cost and long term funding impact. The NCIH had been operational for only 20 months at the time of evaluation and the technology being used is still a developing technology (and will be for the next 2-3 years).

While the NCIH has clear value in providing experience of the practical and innovative development of a broadband network, it has not achieved as rapid a take-up of sites as had been anticipated at the time of forming agreements with the telecommunication companies. It is faced with the need to bring in a wider range of government agencies and associated applications, to integrate its data capabilities with the recent rapid expansion of Internet usage, and to overcome any barriers that may exist based on the cost and confidence in its long term existence. The NCIH experience highlights the complexity involved in taking a large leading edge ICT project from trial to systemic applications and the time scales required.

Identification of evaluation of other government project of the scale of the NCIH has proven difficult. Specific evaluations of individual initiatives do however provide some further insights of potential cost/ benefits of government online initiatives.

In Maryland, USA, the state wide electronic benefits transfer program, which provides multiple state-administered benefits (eg. child support, food benefits) through a single plastic

access card that can be accessed from any automated teller machines, is projected to save the state an estimated $US1.2 million a year.

In California the Merced Automated Global Information Control (MAGIC) system was introduced as a means to combat the problem of escalating costs, deteriorating public services, and declining worker productivity. Since its inception the County estimates that the system has saved $US3.9 million annually due to increased productivity and eliminating the need to hire additional staff, as well as an additional $US3.7 million annually as a result of greater accuracy in eligibility and benefits determinations. Moreover, the MAGIC system has increased the detection of fraud and collection payments, improved case accuracy, created equitable and consistent treatment of applicants, and provided management tools to automate work assignments and provide better case management.

Similar examples of increased efficiency and effectiveness gains can be found in Australia.

The Department of Veteran Affairs Compensation Claims Processing System (CPS) was able to drastically reduce claims processing times, required fewer and less experienced staff to handle claims and was able to provide clients with a much faster and consistent service. With governments moving to electronic service delivery, in the future this service could well be available over the Internet or government information kiosks.

3.5 Summary of Cost and Benefit of ICTs

The dearth of case studies available to evaluate the effectiveness of online service initiatives suggests that there is a need for more on-going evaluation and focused developments that take account of demand information, actual usage of applications and cost and benefit analysis. It is beholden to governments and funding bodies to incorporate evaluation into funding arrangements and program development.

We can only conclude from the evidence readily available that there are indications emerging of the cost benefits of online delivery of government services. It is feasible that ICTs will result in significant reduction in the cost of service provision.

4. Availability of Infrastructure

A key issue in interpreting the possible impacts of ICTs on service provision is the likely availability of technology infrastructure, or delivery platforms, to support services. The telecommunications infrastructure available in regions, will determine the level of services available. The current level of infrastructure in rural and remote regions is a limiting factor. This issue is examined by:

- introducing a framework for describing the characteristics of delivery platforms; and
- examining the characteristics required in different application areas.

4.1 Characteristics of Delivery Platforms

Some key dimensions which may be used to describe and distinguish delivery platforms are:

Bandwidth

Bandwidth refers to width of the frequency spectrum that can be transmitted on a particular channel, and thus influences the capacity or speed of information transmission. The more bandwidth a particular medium has, the faster data can be transmitted across it. Functionally, it is useful to define bandwidth in relation to the sorts of content that can be transmitted.

- **Narrowband**
- **Medium or wide bandwidth**
- **Broadband**.

Table 2 illustrates these different capabilities, by comparing the transmission times of three classes of image.

Table 2: Examples of Image Type and Transmission Times

IMAGE TYPE	SIZE (Mbit)	TRANSFER TIME (uncompressed)		
		9.6kbps Narrowband	64kbps Wideband	10Mbps Broadband
A4 page (text)	0.015	1.6s	0.24s	0.0015s
VGA colour graphics screen	2.6	4.5m	41.0s	0.26s
Landsat	48.0	1.4h	12.0m	4.8s

Source: Newton, Zwart and Cavill (1992) *Networking Spatial Information Systems*, London: Belhaven Press

Extent of Interactivity

Services can be characterised by the nature and degree of interactivity they provide, described as:

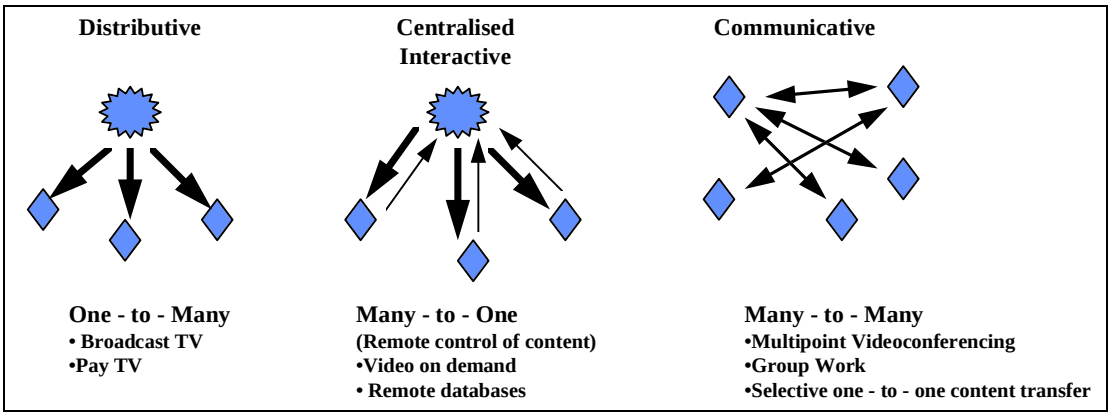
- **distributive**: allowing the user to select from a range of material being broadcast from a central source.
- **centralised interactive**: allowing the user to interact with a central store of information on an individual basis. This is typically understood as being distribution of broadband material with the user being able to send control messages back to select or interact with a body of material.
- **communicative**: allowing two-way communication and transfer of content.

Table 3: Service Requirements in Particular Application Areas*

Sector/Application	Bandwidth				Interactivity			Location							
								Metro					Country		
	Nb	Wb	Bb to 10Mbs	Bb to 155Mbs	Distd.	Cent. Int.	Comm	Specif Locs	Schools	Libs/ commy	Homes/ Bus	Major provin	Med. Towns	All towns	Homes
EDUCATION - SCHOOLS															
Broadbcast Class Rooms			X		X				X					X	
Administrative Systems		X							X					X	
Collaborative work/			X	(X)		(X)	X		X					X	
Materials access															
EDUCATION - VET															
• Homes/bus/commy access	X	X					X			X	X		X		X
• Provider/campus access			X				X	X				X			
EDUCATION - HIGHER															
Campus to: campus				X			X	X				X			
other institutions			X			X		X				X			
HEALTH															
Medical Records./		X		X		country	metro	X				X			
Image Transfer		up country													
Remote Counselling			X				X					X			
JUSTICE															
Remote Hearings			X				X	X				X			
POLICE															
Access		X	X			X		X				X			
Records		up	down												
WHOLE OF GOVT.															
Electronic Service Delivery															
• Kiosks			X				X	X		X		X	X		
• Homes/business	X	X					X				X				X

* Interviews with practitioners and other sources

Figure 1: Characteristics of Interactivity



Source: CIRCIT Ltd

In practice these forms of interactivity may not be clearly distinguished, eg. the infrastructure for Pay TV may provide near Video on Demand.

4.2. Requirements in Key Application Areas

There is no cut-and-dried analysis of the characteristics of ICT services required for key application areas. Table 3 provides indicative examples of the characteristics apparently required by a number of key applications. Although these are somewhat 'ideal' examples, we draw some tentative conclusions about likely requirements for effective applications in the next 5 to 10 years:

- Few applications require very high bandwidth (of the order of 155Mbps), this being primarily a requirement for high-speed large data transmission in higher education and high-speed transmission of visual images in telehealth applications. (Individual institutions might, however, have multiple demands at any one time which aggregate to reasonably high bandwidth requirements);
- Broadband capacity in the range 2 to 10Mbps meets the requirements of most applications, while some require only wideband capabilities;
- Almost all applications require a degree of interactivity or control of content by recipients. Many require a fully communicative capability;
- Most applications require capability available at roughly the level of small towns; and
- If the broad requirements of education sectors were met this would generally speaking provide the capabilities needed by other service areas at appropriate locations.[9]

[9] Improvements in technical capability - in particular compression techniques - could reduce bandwidth requirements for effective video transmission, and ingenuity in application development often leads to a capacity to get effective outcomes on less than apparently ideal service platforms.

We need particularly to examine the prospects for provision of ICT services of the order of 2 to 10 Mbps with interactive and communicative capabilities. Some judgements are, however, that these requirements can essentially be met with the lower capacity wideband ISDN capabilities, particularly as the technical capacity to compress video images improves. Ingenuity in applications development is likely to lead to many approaches to utilising lower available capabilities.

Considerable developmental attention is being given to the range of technologies that could support services to rural and remote areas. There are prospects for a number of approaches available to provide wideband capabilities, particularly in the vicinity of small towns and more broadly with possible cost limitations. Regulatory change that is designed to facilitate competition in various sectors of the market could also encourage development in rural areas.[10] Some examples of this are occurring on a limited basis. For example, AAPT has won a licence to supply a broadband fibre optic network to rural Queensland. Austar, a PayTV service provider has established broadband cable in Darwin and Northgate is establishing a broadband cable network in central Ballarat.

However, many of the benefits of competition have not necessarily been equally distributed, with rural and remote consumers experiencing less competition. At present the telecommunications infrastructure is inadequate to support the systemic use of ICTs in service provision. There is likely to continue to be limited interactive or communicative broadband capability in rural and remote areas over the next five to ten years.

5. Issues in the Effective Future Development of Online Services

The previous sections canvassed the widespread interest and practical attempts to apply ICT to service provision. These considerations establish a degree of feasibility and clear evidence of effort being applied to development. Section 3 indicated the very early stages of evaluation of these developments. Section 4 highlighted the limitations of the current telecommunications infrastructure.

A number of other factors may influence the ultimate systemic implementation of ICT in these service areas. In this Section we examine the likelihood of integrating ICTs into service provision through an analysis of key factors. These are:

- policy and program support for utilising online services in Australia;

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[10] The Department of Communications and the Arts states that, 'the main objectives of the new legislation are to provide a regulatory framework that promotes the long term interests of consumers and promotes the efficiency and international competitiveness of Australia's telecommunication industry.' DCA (1997) *Australia's Telecommunications Regulatory Regime*, Canberra.

- developments in pricing; and
- organisational and other take-up factors.

5.1 Policy and Program Support for Utilising Online Services in Australia

National Approaches

In recent years there has been widespread international engagement with developing policies and implementation bodies to support the utilisation of ICT. Amongst these are:

- the United States approaches to the development of Information Infrastructure through the National Information Infrastructure Advisory Council (NIIA) and the inter-agency Information Infrastructure Task Force (IITF), and the support for approaches to Global Information Infrastructure development;
- Singapore's Intelligent Island IT2000 Initiative which outlined the development of a National Information Infrastructure which would position Singapore as a global hub for business, service and transport and provide access to nearly all homes, schools and businesses across the nation;
- Japan's targets to link every home and business with fibre optic linkages by 2020 and to increase competition in the telecommunications arena; and
- similar Canadian and European initiatives, most notably the Information Highway Advisory Council report (Canada) and the Bangemann Report (European Union).

Information services and associated industries are being seen as sources of national advantage and considerable resources are being expended to support their development.

Australia has been very active in the development of policy and strategies at the national level, through:

- the report of the Broadband Services Expert Group *Networking Australia's Future*, which included proposals for "universal reach" of advanced communication services to rural and remote towns;
- the establishment of the National Information Services Council and its replacement by the Information Policy Advisory Council (IPAC) and the Information Industries Task Force; and
- the establishment of an Online Government Council.

More recently it has embarked upon specific projects to enhance the development of ICT applications and services in rural and regional Australia and the development of telecommunications infrastrucutre through the:

- IPAC Working Party Investigating the Development of Online Services and Infrastructure in Rural and Regional Australia; and
- establishment of Networking the Nation, the Regional Telecommunications Infrastructure Fund that is providing $250 million over five years to enhance rural activities.

These initiatives provide a framework for many activities at the State level.

State and Territory Approaches

As can be seen from the summary in Table 3 there is a commonality in state and territory intentions with regard to ICT strategy, infrastructure, application and service development. The State and Territory governments in general are looking to establish more efficient and effective models to meet their statewide requirements for telecommunication services. These governments have developed strategies to aggregate demand across agencies and to commission whole-of-state Wide Area Networks (WANs). Every State and Territory is also either introducing or contemplating the introduction of some form of electronic service delivery to the public, as well as introducing internal statewide interagency electronic messaging systems.

These activities by Federal, State and Territory governments indicate the strong policy and program support for service delivery using ICTs. There are variations in the approaches to service provision and individual strategies and policies are being implemented. The lack of a consistent and coordinated approach could lead to fragmentation of services. These policies are, however, expected to benefit rural users of online services, in that they will tend to extend the reach of Internet Protocol infrastructure and enhance the business case in these areas for Internet Access Providers. Potentially resulting in more affordable access to telecommunications and key applications.

5.2 Pricing Issues

Telecommunications costs are generally higher in rural and regional areas than in urban areas making online services more expensive and potentially out of the reach of country citizens[11.] The recent liberalisation of Australia's domestic telecommunications market has seen reductions in telephony prices, and an increased diversity of services. However, it is

frequently maintained that call prices are still artificially high compared to underlying costs. It is therefore likely that continued and increasing levels of competition will force prices down, but perhaps only on 'thick routes', such as urban areas, where call traffic is heaviest.

The implications of recent advanced infrastructure roll-out for rural and remote areas is that there is likely to be continuing telecommunications service disparity between these and metropolitan markets.

The price for retail Internet access in Australia is however, believed to be well below the OECD average, with total dial-up costs (local call cost plus service provider access) estimated to be $US93 for 30 hours per month, compared with the OECD average of $US137 (OECD, 1996). Australian rural and remote consumers are required to pay long distance telephone charges to reach an Internet service provider's (ISP) 'point of presence' and may be experiencing a total cost of Internet access between $A6-$A27 per hour, depending on where they are located. This problem is being partly addressed by the growing numbers of rural-based ISPs offering communities local call Internet access (Buckeridge, 1996).[12]

While telecommunications access in Australia remains distance-dependent, both in terms of distance-based call charges and the physical reach of infrastructure, then current disparities in service provision are likely to prevail in the foreseeable future. Although the availability of wireless communications platforms could overcome problems of infrastructure access to some extent, there is still a degree of commercial and technical uncertainty about these technologies.

One suggested approach has been to ensure the interoperability of networks at all levels of government, which would help to build a critical mass of network users, and provide an assurance for infrastructure providers of sustainable revenue streams (Cavill, 1996).

5.3 Organisational and Other Takeup Issues

In this Section we have focused primarily on the "supply-side" of industry developments, infrastructure availability and pricing outcomes. A number of other factors are likely to contribute to the timing and scale of adoption of ICT based approaches of service provision. These include:

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[11] Department of Premier & Cabinet, Project Lighthouse, Queensland 1996. This is particularly true for remote Aboriginal communities.

[12] It was reported at a recent CIRCIT workshop that some rural areas are experiencing intense competition by Internet Service Providers (ISPs) pushing prices down to as low as $1 per hour. In the central northern Victorian region there are between eight to ten ISPs actively competing, all have established in the area over the past 18 months (CIRCIT, 1996b).

- The adaptability of organisational structures

  The widespread utilisation of ICT for service provision can present difficulties for organisations in changing systems and professional approaches. Some examples include: privacy issues associated with, and perceived resistance of the medical profession to, sharing of patient information; the timetabling issues associated with receipt of satellite learning programs.

- Skilling

  While younger employees in service provision roles may increasingly have ICT related skills, there is a significant cohort of established employees with limited skills and possible disinclination to explore new approaches. This has been recognised as an impediment to take up of many technical developments in education.

- Approaches to substitution

  Research into consumer behaviour suggests that individual consumers "mix and match" the modes of ICT service to various activities, rather than totally substituting particular modes for previous approaches (Singh, Bow and Wale, 1996). Organisational responses to these phenomena are still unclear. They may range from imposing a form of substitution, through incentives to decentralised service providers, to maintenance of dual systems with perhaps little direct cost saving but enhanced service provision.

- Knowledge of potential demand

  Assessing potential demand for services and applications is an important planning tool that can reduce the development of services and applications for which there is little demand and provide impetus into developments which will service needs.

- Evaluation

  A lack of adequate and ongoing evaluation of trial and established projects which can result in unwise investment. This may also result in the unnecessary duplication of services that are unsuccessful and/or inadequate.

- Human factor issues

  Failure to understand the human factors necessary for acceptance and adoption of online services. The integration of technology into organisations is highly dependent upon acceptance by providers and users including for example, health care practitioners and patients, teachers and students. Adequate induction, training and support programs are vital to the success of online services, yet they are often overlooked.[13]

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[13] John Mitchell & Associates, *Establishing Renal Clinical Telehealth*, http://192.131.13.10/`jma/tqehrep.htm

- Coordination of services

  There is demand for seamless access to the three tiers of government information via a single window system. This requires far greater coordination between all levels of government than presently exists. The use of common software and database applications and organisational change are areas needing particular attention.

7. Conclusion

This review of prospects of the utilisation of ICT reducing costs associated with the provision of services to dispersed communities has led to the following conclusions:

- A wide range of ICT applications in the key service areas of health, education, justice and whole of government services can be observed in Australia. Many of these are in trial or early development stages.

- The cost-benefit analysis of many of these applications is not yet established. There are indications of significant potential cost savings but there are few informative and strict evaluations.

- The infrastructure for utilisation of emerging telecommunications services is likely to continue to be differentially distributed with widespread terrestrial cable networks being primarily located in urban and major provincial areas. Rural and remote areas may be dependent on developing wireless services for some applications, although institutional access - e.g. for schools, libraries and hospitals- may occur through terrestrial links.

- The prospects of price reductions and price equivalence between urban and rural and remote areas are uncertain. Regulatory and technical changes may reduce the costs to rural and remote areas.

- There is a significant push in all Australian States to utilise ICT in service delivery, supported by national strategies and policy frameworks.

- The graduation from trials and developmental activities to systemic applications of ICTs requires resolution of a number of organisational and other take-up issues.

Overall, it is clear that there is real potential for the utilisation of ICT services to affect the capability for service provision to rural and remote areas. Key questions remain on the timescale, breadth, and detailed nature of this impact. Although it is feasible that significant reduction will result from ICT based service provision, it is unlikely to occur in the specified timeframe.

It seems likely that ICTs will have an impact over the next 5 to 10 years, although the initial period may be largely a period of implementation and proof of widespread effectiveness, with greater infrastructure availability and experience leading to further benefits in the latter part of the period and subsequently.

Discerning trends in a time of transition in a manner which forms a sound base for policy formation requires ongoing monitoring of a number of dimensions, including the detail of applications development, cost and benefit analyses and infrastructure possibilities. A more coordinated approach to policies would also prove beneficial.

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