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27 Electric Telegraph to e-Scotland: Networking remote and rural communities

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There are said to be parallels in the impact that the advent of the telegraph and the internet had on their respective societies.[1] This chapter looks at two examples of state intervention and subsidy in the development of those two communications infrastructures in remote and rural areas of Scotland, at either end of the revolution in electric communications. Both applied the technology of the day to break down geographical barriers, to increase connectivity, to spread information, and to enhance social and business links. Both initiatives grew in part out of a government concern that Scotland should not fall behind the level of technological provision available in other European countries, thereby disadvantaging Scottish business as well as citizens (a comparison with the state-owned telegraph systems in Belgium, Switzerland and France informed the 1868 Telegraph Act, and the development of a broadband infrastructure across a range of European Union countries has been quoted by the Scottish Government). The emphasis in both cases was on *affordable* wide-ranging availability to benefit individuals as much as business, though with an understanding that business needs would be the driver and would provide the bulk of the finance to establish and maintain the infrastructure.

The first was a product of nationalisation with the expansion of the telegraph network from 1870 to 1872 driven by demand. Following is an analysis of that demand and its impact, alongside a description of the development of the network across remote and rural areas over the two years of the scheme.

The second examines the rationales behind Scottish Government initiatives since 2001 to extend broadband provision and outlines the technical solutions devised in partnership with commercial operators and funding bodies to reach non-commercially viable areas and to stimulate take up.

THE HIGHLAND TELEGRAPH SCHEME, 1870 TO 1872[2]
The scheme to provide an electric telegraph service to the Highlands and Islands of Scotland during the period from 1870 to 1872 greatly fired the public imagination, not only because of the public and commercial advantages of the service but because people could see the reality of it in the form of poles and wires and read almost instant news brought to their local newspaper of events happening around the globe. The telegraph made the world a more accessible place and therefore more inclusive. It made communication to and from the remoter parts of Scotland no longer so bound by constraints of distance and topography. Shifting provision of this means of communication from private to public enterprise started to break down what media theorist Harold Adams Innis referred to as 'monopolies of knowledge'[3]; it shifted access from the élite, to a mass communication medium.

Against the prevailing ethos of private enterprise, several proposals had been forwarded in the 1850s to bring the British telegraph systems under public control, in line with the postal services and in keeping with most European countries whose systems had been under government control from the start. The government had long

seen the benefit of control over this means of instant communication and had reserved the right to take possession of the private telegraph system 'in case of riot, disturbances, or other public emergencies'.[4] It had done so once, on 10 April 1848, for a few days to counteract the Chartist movement.[5] The advantages of a telegraph system to control outposts of Empire from London became apparent after the its use during the Crimean War (1854-1856) and the rebellion in India in 1857.

In Edinburgh, in 1865, a more local but determined campaign was launched by the Chamber of Commerce 'to consider the present condition of Telegraphic Communication in the United Kingdom, with a view to its improvement' and by newspaper publishers to replace the systems of the private telegraph companies by a state monopoly.[6] Their chief grounds for complaint centred on the high charges for transmission, delays and inaccuracies in the service and lack of infrastructure in the north, all issues they felt would not be resolved while the telegraph network remained in private hands.[7] The application of a standard charge for passing messages irrespective of distance (as existed in the Postal Service) offered a great advantage to newspapers outside London, and it was mainly due to the sustained pressure of these newspapers over a period of three years that the campaign succeeded.

On 31 July 1868, an act of parliament was passed that laid out the fundamental concept of state ownership. The act stated that:

> Whereas the means of communication by electric telegraphs within the United Kingdom of Great Britain and Ireland are insufficient, and many important districts are without any such means of communication. And whereas it would be attended with great advantage to the State as well as to Merchants and Traders, and to the public generally, if a cheaper, more widely extended, and more expeditious system of telegraphy were established in the United Kingdom of Great Britain and Ireland, and to that end it is expedient that Her Majesty's Postmaster General be empowered to work telegraphs in connexion with the administration of the Post Office.[8]

This left only the details of compensation and the method of raising the money to be resolved. The 1869 Act incorporated the Act of 1868 and stated the total compensation to be £5,715,048 8s 11d, which was divided amongst six telegraph companies.[9]

THE TRANSFER TO STATE OWNERSHIP
At close of duty on Friday5 February 1870, the state formally took over electric telegraphs and, on the following day, opened a public service from 2,488 offices, many at railway stations, but also including postal telegraphic offices, each serving its own local community. It was from these local post offices that the vast bulk of messages were sent over the first year of service. The new Telegraph Department employed many of the private company employees and established new training schools in Glasgow and Edinburgh for telegraph 'manipulators' to operate the system.

By 1872, the number of telegraph offices had doubled to 5,000, the number of telegrams increased to 12 million (50 per cent more than before nationalisation), and the number of words transmitted by the press increased from two million to 220 million.[10] Part of the purpose of nationalisation was to shift the use of the telegraph from a business tool to provide a greater public benefit. In a report on the

reorganisation of the telegraph system, Mr Frank Ives Scudamore, Accountant General and Chief Administrator of the Post Office, wrote:

> Those who advocated the transfer to the Government contemplated a radical change in this respect. They proposed, by the establishment of a low, uniform and very simple tariff, and by bringing the wires close to the population, to popularise telegraphs in this country, to put the use of the telegraph within the reach of everyone, and to make that, which had hitherto mainly served the purpose of the wealthy and the speculative, minister to all the necessities of social and domestic life.[11]

To comply with this aim to provide a public service, it was necessary to extend lines that would be expensive to run and slow to show a profit as well as the comparatively less-costly exercise of providing a service to locations close to existing lines. To this end, Post Office officials had, for some time previous to the transfer, been surveying the existing systems and planning the extensions of new ones. The planning and estimating of new lines was helped by the almost-completed 6 inch and 25 inch to the mile ordnance survey of most of Great Britain. The ordnance survey was being carried out by personnel from the Royal Engineers and it was to this labour resource that the Post Office turned, as a body containing an already trained Telegraph Battalion for wartime duties and available for the physical work of establishing a network of poles and wires across the north and west of Scotland. The arrangement to employ the Royal Engineers on the same terms as on the ordnance survey made possible the development of an infrastructure at a cost and to a timescale which would have been hard for pre-nationalised companies to achieve.

Prior to 1870, northern Scotland, like the rest of Britain, was served mainly by telegraph lines built along railway tracks. The railway companies had either leased the lines to the private companies, or were using them themselves for both business and railway signalling. However, not every railway station offered public access to the system; such stations as Muir of Ord, Kildary, Invershin or Lentran were not opened for telegraph traffic until the end of 1870. The west of Scotland from Oban northwards was completely without telegraphic communications. In the east, a line had been constructed in 1868 by the Electric and International Telegraph Company from the then northernmost railway station of Golspie, via Helmsdale and Dunbeath to Wick and Thurso. A submarine cable had been laid via Hoy to Kirkwall and another to Shetland by the Orkney and Shetland Telegraph Company. Prior to the transfer, the Post Office had been augmenting the existing lines from Edinburgh to the north. By February 1870, the telegraph service had reached Kingussie. It had reached Inverness from the south by way of Aberdeen and then, after the opening of the Aviemore to Grantown railway in 1863, via Forres.

On Saturday 6 February 1870, the 30 per cent increase in business over the country generally was surpassed in the north of Scotland by a 100 per cent increase which, in Inverness, was maintained even during the following Monday.[12] This was to give rise to a hope that the standard rate might be reduced from one shilling to sixpence for twenty words, but more important perhaps, was the fact that the increase in demand for the new service was such that the existing system was unable to cope.

THE CAMPAIGN FOR IMPROVED SERVICES
From the inception of the state-owned telegraph service in the north of Scotland, there was an incessant campaign to have the service improved. The campaign took the form

of complaints from the press, who were dependent on the telegraph for much of their news, as can be seen in reports in northern newspapers from February 1870 and by the vast increase in the number of words transmitted by the press after nationalisation. In August 1870, the *Invergordon Times* newspaper reported: 'The Post Office seems to be quite unable to undertake the work placed at its disposal'.[13] In September, the *Inverness Advertiser* complained: 'Telegraph disarrangements in the north – there is something altogether inexplicable in the management – or mismanagement – of the supply by the Post Office of telegraph news to the northern press'.[14]

On 24 September 1870, a meeting in Inverness specified examples of both postal and telegraph ineptitudes. From the meeting a memorial was sent to London outlining complaints about the service and hoping a solution would be found. Eventually, at the end of December 1870, Mr Scudamore replied that a new wire was in the course of erection between Inverness and Edinburgh and that the link between Inverness and Edinburgh via Aberdeen was to have an improved system of apparatus on the wire; that a new wire had been erected between Inverness and Lairg and that the hours of receiving messages at Inverness Post Office would be extended from 9pm to 10pm.

Meanwhile, in Stornoway, similar representations were being made arguing that, if Tongue on the very north west of Scotland was to have service, then surely Stornoway, with its larger population and important herring fishing fleet, should also be served.

THE PROPOSALS
In February 1871, a survey was made in the Oban-Fort William area. It was decided to join up with the existing Inverary-Oban line at Connel ferry, cross to Benderloch, by the Shian Ferry and Appin to Ballachulish, across Loch Leven, along the shores of Loch Linnhe towards Fort William, and then to Ardnamurchan. This route required submarine cables to be laid across Connel, Shian, Loch Leven and Corran.

In March 1871, plans were prepared to link Inverness and Fort William via Fort Augustus. To serve the Black Isle, it was intended to carry the wires from Conon Bridge to Fortrose and, as a result of a memorial sent in by Cromarty Town Council, the route was to be continued to Cromarty. From Tain, a line was to serve Portmahomack and Dornoch.

The proposal to link the Hebridean towns of Portree and Stornoway with the mainland was to meet with some obstacles, as negotiations over this infrastructure's version of a public-private partnership caused some delay. Negotiations for a mail-carrying contract with the newly operational Dingwall and Skye Railway Company had broken down and legal proceedings were pending. Because of this situation, it was decided not to use the railway poles, but to erect poles from the Post Office at Dingwall, along the public road by Strathpeffer and Garve to Achnasheen. A line would then be constructed to Kyle and one via Kinlochewe and Poolewe up the west side of Loch Ewe to An Sguiteach, near Cove. Although it had been accepted Post Office policy to take an alternative route when in dispute with a railway company, the case of the Dingwall and Skye Railway Company was taken up in the House of Commons, and a debate followed. Was it less costly to maintain a line along the railway or the highway? Was the annual charge for a railway wayleave more expensive than the interest on the capital investment required for a new line along the road? Meanwhile, as the argument continued, the poles were erected by the army along the Strathpeffer road.

BUILDING THE NETWORK

Notwithstanding some difficult relations with private companies, once the work was planned and the army workforce in place, the network grew at speed. Between April and August 1871, wires were run from the post office in the High Street, Inverness, along the public road to Fort Augustus and Fort William. In the summer of 1871, the Norwegian brigantine *Agil* arrived at Gairloch with a cargo of 2,000 poles, unloaded 500, and sailed to Poolewe, where several hundred poles were unloaded. The remainder of the cargo was landed at Tobermory for the construction of the Mull telegraph network.

From Connel, poles were erected along the route decided earlier in the year. On 30 June 1871, the cable ship *SS Robert Lowe* laid the Oban to Mull cable; on 3 July, the Loch Etive cable above Connel Falls; on 4 July, the Loch Creran cable near Shian Ferry; 5 July, the cable to Ardnamurchan at Corran Ferry; and, on 8 July, the Islay and Kintyre cable.

Meanwhile, in London, the argument for using the railway companies' poles having prevailed, orders were sent to recover the poles erected along the Dingwall-Strathpeffer road, and for the soldiers to proceed to Achnasheen. On 25 August, the line reached the terminal pole at An Sguiteach and the arrival of the Stornoway cable was awaited. In August 1871, Portmahomack, Aviemore and Grantown were opened for public business. In September, the offices at Castletown, Brora, Dornoch and Appin were opened, and those at Drumnadrochit and Fort Augustus were opened on 13 October 1871, six months after the start of the network construction.

CONNECTING THE WESTERN ISLES

An initiative to network the Western Isles and link them to the mainland was also underway, if not progressing as fast as the rest. Plans were being prepared to link Kyle with Portree and Dunvegan. For Harris, a line was to be erected from Stornoway to Rodel and from Rodel a cable would be laid to serve Uist.

On 24 June 1872, the *SS La Plata* arrived in Stornoway. The cable lay started at one o'clock on 28 June. Performance tests were made every half-hour during the voyage. After her arrival in Loch Ewe at 6.30pm a message was transmitted to Mr Donald Munro, Stornoway town chamberlain: 'I have much pleasure in informing you that the cable connecting the Western Hebrides with the Mainland has been successfully completed today'. The cable between Lochmaddy on North Uist and Rodel on Harris was laid by 5 July. The Stornoway cable remained in service until 1933 when it was replaced by a telephone cable.

The successful completion of the circuits from the Western Isles, Kyle, Gairloch and Ullapool was not yet achieved. It was not until towards the end of August that the Post Office agreed on an annual payment to the Dingwall and Skye Railway Company for use of their wires. The result was that the wire was connected to the railway telegraph and, on the last Monday of August 1872, the office in Stornoway opened for public business. At the beginning of October 1872, it was joined by offices in Dunvegan, Easdale, Harris, Invergarry, Isle Ornsay, Broadford, Loch Carron and Strome.

CONCLUSION

The Highlands and Islands scheme of 1870 to 1872 was proof of the new state-operated telegraph system's pledge 'to put the use of the telegraph within the reach of everyone' and the amount achieved in two years is impressive. Once nationalisation had been mooted, little work had been carried out by private companies, either to

extend or maintain the infrastructure, but expectation of the new state-owned system had been mounting, so that 'the Post Office started with a heavy arrears of work upon its hands, and heavily in debt to public expectation'.[15] It also came at a much greater cost to the government than had been anticipated both in initial outlay and in running costs, to the extent that the Post Office telegraph service did not pay its way. The network was to remain substantially unaltered for sixty years.

Although the figures show that telegraph use did increase hugely and the standardisation of cost made it affordable, for the majority, the reality of the telegraph was that it would remain 'a medium of communication which they might use in times of sore necessity'[16] as for most occasions, an efficient postal service was much cheaper. Its immediate impact remained with the press and with business. The importance of the project however, lies in its egalitarian ideals. Orkney and Shetland however, linked by two submarine cables to the mainland, were the only lines in Scotland that continued to be worked by private companies, under licence, who charged an extra fee above the Post Office standard rate. These lines were eventually brought under state ownership in 1876 and 1877.

TELEPHONY

The experience of the Highlands and Islands Telegraph scheme, although deemed a success, demonstrates the logistical and financial difficulties of undertaking such an initiative. After the nationalisation of the telephone system in 1912, there was a concerted effort to extend the network of rural exchanges across the UK in the first few years, which benefited both the Highlands and Islands and the Borders region.[17] During the subsequent, more sporadic evolution of the telephone network, as well as being among the last repositories of older technologies, Scotland's remote communities were also targeted for experimental new ones.

In the 1960s the Post Office in Scotland pushed to expand and improve telecommunication services to remoter areas, which were falling behind provision elsewhere in the country.   A report published in 1965 on the modernisation of the Highlands and Islands telephone system identified two parts to the programme[18]. Firstly, an upgrade of exchange equipment from manual to automatic, which in turn allowed the extension of subscriber trunk dialling (direct dialling by one caller to another routed through automatic exchanges).   Secondly, the building of a chain of radio links between exchanges as well as for some customer lines, to streamline the convoluted connection routes which had evolved between exchanges as the network had expanded over the years. Building these radio networks proved a 'gargantuan task' echoing the roll-out of the telegraph network nearly a hundred years earlier but this time with labour from the Scottish Division of the Ministry of Public Buildings and Works.[19] The switch from manual to automatic at the exchange at Baltasound on the Shetland island of Unst in 1974 meant that 'for the first time, lighthouse keepers off the remote Scottish island of Muckle Flugga could dial direct the length of Britain to their colleagues on Alderney in the Channel Islands'[20]. Operator Agnes Dewar connected the UK's last call through a manual exchange at Portree on the Isle of Skye on 14 October 1976. Three years later, on 17 September 1979, the first digital exchange in the UK was trialled at Glenkindie, in the Grampian Mountains, each event marking a last and first at either end of the automatic electro-mechanical telephone age (Scotland's first automatic electro-mechanical exchange came into use in 1916 at Paisley, 4 years after the first in the UK at Epsom in Surrey). Electro-mechanical exchanges in turn became obsolete with the replacement of the last switching system with digital on Foula in Shetland in July 1995.

The challenge of connecting Scottish communities has always been that of linking networks serving rural and remote areas, the Central Belt and cities elsewhere being no different from any other conurbations. The issue applies equally into the 21st century as networking Scotland for internet broadband reached a new dimension with the aim to provide complete geographical coverage, the rural and remote communities presenting once again the infrastructural challenge which led to experimentation and development of new technologies.

BROADBAND CONNECTIONS 2001- 2005

In December 2003 young people on Barra, one of the southernmost islands of the Outer Hebrides, lobbied MSPs and mobile phone network operators for better coverage for their island. 'We feel behind the times and a step behind all other teenagers in Scotland', they complained.[21] They went on to argue that a better networked island would bring benefits not only to their social lives but to businesses, tourism and emergency services. Nearly 130 years after the scheme to create a telegraph infrastructure for the Highlands and Islands, similar issues of accessibility and connectivity were being raised by plans to bring broadband internet access to remote and rural Scotland.

Since the deregulation of the communications industries in the 1980s, successive governments have invested in telecommunications to provide internet access to rural Scotland over the last twenty years, through Highlands and Islands Enterprise, Scottish Enterprise and European-led projects.[22] The then Scottish Executive launched its strategy for broadband provision in 2001 with its document *Connecting Scotland: Our Broadband Future*. It set out the Executive's strategy for extending the availability of broadband services in Scotland. Echoing Frank Ives Scudamore's telegraph vision of 130 years earlier, their aim was 'to make affordable and pervasive broadband connections available to citizens and businesses across Scotland'.[23] Government intervention in the provision of services was based on the assessment that, as previously, private companies would deem such provision to remote and rural areas unprofitable, or would only offer it at prices which would place users at a great financial disadvantage. The key issues at this stage were access and cost (though without the emphasis on the benefit to the state in 2001, which was felt to be a legitimate issue in 1868). From the launch of the programme the pace of change was rapid with target broadband coverage percentages across the country being met faster than predicted. Unlike the previous telegraph experience when costs were grossly underestimated, technological advances meant that the initial estimates for the cost of the work fell over the period of implementation.

The communications manifesto was updated in December 2002 as *Connecting Scotland: Our Broadband Future: Making it Happen.* It included a development on the previous one: the recognition of the need to stimulate not only the supply of services but demand and take-up too.[24]

The aim was to create a communications infrastructure capable of future expansion and upgrade, thereby limiting the perceived social and technological divide created by lack of broadband access. The Scottish Executive recognised the ever growing importance of telecommunications in a globalised world, as a consequence of which Scotland has experienced the loss of call centre jobs to India over the last few years, to give just one example.[25] Scottish businesses gaining the competitive edge

offered by the internet was one of the main drivers to the Executive's broadband vision.[26] The notion of electric communication shrinking the world was commonly associated with the advent of the telegraph and the theme has become key to the internet. Global accessibility and speed opened up new ways of interacting whether for work, learning or leisure.

In June 2004 the Enterprise Minister announced the aim to provide *affordable* broadband access to 100 per cent of Scotland's communities[27] by the end of 2005. This impacted most on the Highlands and Islands and the Borders, where provision lagged behind the Central Belt and urban areas.[28] Affordable here meant a service at the same price as it was being offered in urban areas across the UK, in the same way as the Penny Post in 1840 and the Telegraph Act of 1868 standardised charges across the country (less bandwidth in remoter areas as well as lack of choice of service provider compared to urban users became as much of an issue as cost later on in the roll-out). In comparison with the expansion of the telegraph network, state intervention in broadband provision remained for the most part at one remove during the earlier phases, stimulating the commercial development of the infrastructure by commissioning provision for the public sector such as health, social services and school use, promoting take up campaigns and working in partnership to support the development and use of new forms of network. Direct state aid was made available only for the provision of broadband to parts of Scotland where there was no planned commercial coverage and took place only after the necessary tendering processes were completed.

CONNECTING SCOTLAND: MAKING IT HAPPEN
The Scottish Government's target of 70 per cent broadband coverage by March 2004 was met in January 2004 across the country as a whole, but with significant disparities across the regions. At the beginning of 2004, around 45 per cent of households in the Highlands and Islands had access to broadband, the lowest access rate in the UK, compared with 75 per cent for Scotland as a whole. The estimate at the time was that 80 per cent of the Highlands and Islands would be networked by summer 2005 (97 to 98 per cent for Scotland as a whole), a combination of upgrading by private communications companies and intervention by the then Scottish Executive and its Enterprise bodies. Scottish Executive targets related to availability of broadband only and not to the number of customers connected, for which there were no targets. This was despite the importance placed on uptake in the *Connecting Scotland* manifesto and projects to stimulate both supply and demand, particularly in rural areas, run by Scottish Enterprise's *Broadband for Business* programme and the Highland and Islands Enterprise's *Speak Up for Broadband* campaign.[29]

At the time, most 512kbps (kilobits per second) broadband provision was based on upgrading the technology in telephone exchanges to provide an ADSL connection through the use of the existing copper wire and optical fibre networks to the customer's premises put in place for the telephone, or more recently for cable TV.[30] This worked for the large majority of customers in more densely populated areas where users are close to exchanges but was not always feasible for rural and remote connections. Given the Highlands and Islands and Borders regions' topography, the state drive for 100 per cent broadband coverage meant enterprise bodies working with telecommunications companies in developing new technologies to meet the targets and provide what one supplier referred to as 'a patchwork of solutions to broadband Britain, depending on population density, ranging from high speed fibre to

the home in core areas, out to satellite or leased lines in the most remote areas'.[31] This placed Scotland at the forefront of developments in broadband provision. By 2005 the Borders area and the north of Scotland had some of the most advanced fixed wireless networks in Europe. Broadband services using wireless links back to the mainland network were established to the most populated areas in each of Scotland's three main island communities, the Western Isles, Orkney and Shetland, at the beginning of 2004, initiated and part funded by Highlands and Islands Enterprise. European funding was awarded to Highlands and Islands Enterprise towards the Western Isles *Connecting Communities* project in January 2004 to provide high speed wireless broadband services to all of these islands. The wireless network of masts down the 'backbone' of the Western Isles was in place and operational by the end of 2005 with a second phase of infill masts to connect the remaining very remote areas being developed during 2008. The *Connected Communities* website sums up the benefits for theses communities.

> "The 'Connected Communities' island network will utilise a combination of fibre and leading edge Wireless Broadband Base stations and multipoint in-community links. This will allow new networks to be demonstrated in community locations and provide teleworkers and local companies high speed connections through wireless antennas. Initially schools, healthcentres and Council offices will receive a high speed connection and through this same infrastructure the rest of the community will gradually have access as the network develops."[32]

Electricity distribution networks, with virtually 100 per cent coverage of the population, were considered for the provision of broadband.A system using them to deliver broadband connection through electricity sockets had been piloted around Crieff and Campbeltown since June 2002.[33] The economics of extending cable or fibre telecommunications networks beyond urban areas was widely acknowledged as a major hurdle to broadband expansion. The proximity of an enabled substation remained an issue and there were unresolved concerns over interference with radio reception and emergency services communication.

For remote areas, satellite broadband became available across Scotland in April 2003, after trials in the Highlands and Islands. It remains an expensive option, with some technical limitations. The Scottish Government allocation of grants to overcome the high cost of connection to satellite broadband helped to promote the use of the technology in remote locations and it was taken up by thousands of businesses.[34] The above initiatives were the result of partnership agreements between government agencies and the private sector but the direct state intervention mentioned earlier to provide broadband to remote and rural areas, where no planned commercial coverage existed, was approved by the European Commission in 2004 on the grounds that broadband is seen as a necessary step in the modernisation of the EU society and economy and is a pre-requisite for the development of e-government, e-learning and e-health projects.[35]

DEVELOPING THE NETWORK AFTER 2005
On reviewing the situation in 2006, the Government found they had successfully met connectivity targets to 100% of communities, but within these there were still clusters

of individual customers all over the country not yet receiving satisfactory connection for broadband, despite having their telephone line connected to a broadband-enabled exchange.[36] Reaching these several thousand potential users became a priority. A report undertaken by Mason Communications Ltd for the Government in 2006 summed up the situation.

> Broadband availability in Scotland is amongst the highest levels in the developed G7 countries, and is an excellent reflection of the combined efforts of the public and private sectors. However, this is little comfort for those without broadband, who become increasingly frustrated with broadband claims, advertising campaigns and increasing levels of provision within the well-covered areas. This level of frustration is likely to increase as the overall coverage levels extend towards 100% availability.[37]

They set out the reasons for this failure to reach all customers.

> **….** it is extremely difficult to predict if a telephone line will support broadband ADSL services. Availability is down to a complex mix of technical variables, which can change over time. The main measure of availability is the length of the line as the ADSL signal is attenuated with length until it becomes unworkable. However, research has shown that even for some very long lines, local conditions can mean that a service is still achievable; conversely for some shorter lines, a service may not be available. **In the end, the only absolute way of knowing is to order a service and try to provision.[38]**

Enabling these last few users would be achieved at a relatively very high cost. The view of those at Mason Communications Ltd was that by 2006 a level of expectation of 100% connectivity was now such, that the Government should see their initiative through to completion. The Government launched its *Broadband Reach Project* on 5 October 2007. Its aim was to deliver affordable, *sustainable* broadband services by the end of 2008 to those households without services. The Government adopted a demand-led initiative to this phase of connectivity, with a tailored solution to fit an individual connection problem. Customers were invited to register as wanting a broadband connection by 18 January 2008. Three thousand responded. There were two possible technical solutions – either an upgrade of the telephone wiring from the exchange to the premises, or the directed use of a fixed wireless connection. A government tendering process identified any commercial company interested in the work. If no provider expressed an interest in enabling the user on a commercially viable basis, the Government was able to offer individual grants for the work.

IMPACT ON SOCIAL INFRASTRUCTURE

The benefits of a technical infrastructure for rural and remote communities may appear to justify the financial and environmental costs. The impact of a new technical infrastructure on the social one may take longer to quantify.[39] The impact of the internet and broadband on new ways of work and leisure are still relatively new. In 2004, at the time of the Government's *Connecting Scotland* initiative, take up in

Scotland as a whole stood at 39 per cent of internet connected businesses (less for domestic use) compared to 19 per cent in the Highlands and Islands and 20 per cent in the Borders, below the UK average.[40] By 2006, Ofcom's[41] figures were showing that broadband take-up in Scotland has risen to 53 per cent of homes (compared to 58 per cent in England, 52 per cent in Northern Ireland and 45 per cent in Wales), but with considerable variation across the country.

> Aberdeen (64%), Dundee, Edinburgh and Highlands & Islands (all 62%) were substantially ahead of the UK average of 57%. But this contrasted with Glasgow where penetration was 32%, constrained by the low ownership of PCs in the city (44%, compared to the Scottish average of 64%) and probably also by low average household incomes. Broadband take-up was higher, at 59%, in Scotland's rural areas than in urban areas (52%).[42]

Providing the infrastructure is only the beginning of a process of establishing human engagement with the technology to benefit business, health, local authority and education services as well as new forms of personal communication and entertainment. Therefore, alongside the Government's initiatives to expand the network, it recognised the importance of access to impartial information and a choice of supplier. From an independent perspective, staff at Lews Castle College, part of the University of the Highland and Islands, have undertaken a study to determine the aspirations and potential demand for broadband connection among Western Isles communities and businesses.[43] Their results show a population with a high level of ICT literacy and computer ownership (89 per cent in 2003), but a lack of clarity about the benefits of broadband beyond quicker download times, due to lack of exposure to the technology. The authors identified the need for a change in social as well as business perceptions before the full potential of the technology would be realised. Its deployment needs to go hand in hand with community consultation, training of local people to train others and time for awareness of the benefits of the technology to be absorbed. During the first phase of network development up to 2005, the then Executive's solution was to lead with the public sector and provide broadband internet provision in the Highlands and Islands and the Borders for NHS, e-learning in schools and colleges and local authority. This would introduce the applications of the technology at community level and help establish it as a tool at a local level.[44] Within the short interval of three years, the second phase to expand the network to include the last 1% of the population without connectivity is being carried out in a world infinitely more accustomed to the concept and perceived benefits of broadband, which has in many respects become the norm. Promoting take-up, therefore, is no longer an issue and this phase is being driven by demand.

CONCLUSION

The drivers of access, cost, demand and sustainability for broadband identified by the Scottish Government are equally relevant for earlier assimilations of technologies. All need to be met if the technology is to become integral to the way people live and work. But, ultimately, demand is key, however comprehensive the access and sustainability or affordable the use.

The extension of the telegraph network was demand led as people could understand the benefits that access would bring and had expectations of it not only on a practical (usually business) level but also on a psychological level as a means of

being connected to the rest of the country and the globe. Despite this, nationalisation of the telegraph was not a financial success and for many people the familiar and efficient postal system met their daily needs.

The Scottish Government's push to provide broadband coverage for the country in 2004-5, alongside existing private sector initiatives meant provision may have overtaken demand, perhaps for the first time in a technology roll out. At the time, even those interested in the technology would cite lack of broadband connectivity in their area as an obstacle when this was often no longer the case. Awareness of availability grew fast and changed the situation very rapidly. Take up by businesses in Scotland has more than doubled year on year for the last few years.[45] Demand registration websites and local campaign groups helped to raise awareness and provide access as the active and successful *Speak Up for Broadband* campaign testified. As a result, demand-led community campaigns led to enabled exchanges or wireless connection from Lhanbryde in the east to Achiltibuie in the west, just as the memorial by Cromarty Town Council in 1870 led to their connection to the telegraph network, or indeed the Western Isles who lobbied for their submarine telegraph cable. The high cost of some alternative broadband technologies, such as satellite, remained an issue, even with state-subsidised use.

In 2008, the potential for broadband at ever greater bandwidths is vast but it still remains cutting edge for many and as such it may take some time yet before its benefits are perceived by all and it becomes embedded as a means of communication. Consequently, many users continue with the established internet, mobile phone, or even landline technologies which serve their daily needs, just as the postal service did in the telegraph age (and continues to do). It will remain so until such time as it is perceived as opening windows of personal and economic opportunity rather than purely as a means of doing what people are currently doing on the internet, but faster. Howard Rheingold, writing on the social implications of technology, says this shift will come when broadband combines with wireless connection.

> Wiring the world over the past century, from the telegraph to the Internet, disrupted old social patterns and led to the creation of new ones. Unwiring the world over the next decades will disrupt existing social arrangements just as profoundly…..High data-speeds made possible by radio-based technologies are likely to multiply the effects of mobile Internet in unpredictable ways as well. In digital media, quantum leaps in speed often trigger qualitative jumps in the way people use them.
> Just as photography changes to cinema at 24 frames per second, and the Internet changed to the Web at tens of thousands of bits per second, broadband portends a transformation in the nature of the medium of mobile Internet. Broadband is about data transfer rates of ten of millions of bits per second. Combine high transfer rates, yesterday's supercomputer on today's chips, and p2p [person to person] methodology, and many things presently unimaginable become possible.[46]

As for the Scottish Government itself, the egalitarian ideals demonstrated by a predecessor government by connecting people through the telegraph has now evolved to connecting and engaging people in government itself – e-democracy. The Scottish parliament has positioned itself as the one of the most interactive parliaments in the world, via the internet. This means opening up the processes of government to direct individual intervention, at local and national level. The Ofcom figures above though

point to the opening up of a new digital divide where the urban poor seem to be most at risk of disadvantage. But a more fundamental divide remains, as Neal Ascherson has pointed out: 'The real digital divide in Scotland is not between those with money to buy the kit and those without. It runs between those who can read and write, and the tens of thousands who are functionally illiterate'.[47]

Scotland, along with the rest of the UK has among the highest terrestrial broadband provision at 99.6 per cent, world leaders with South Korea, Japan, France and the US. Take-up rates, although increasing fast, still lag still behind other countries. The exchange at Castlebay on Barra was broadband enabled on 13 July 2005. Those teenagers participating in e-democracy by lobbying their MSPs perceived the technology not just as a means of communication but as part of a cultural landscape described by Howard Rheingold, from which they would otherwise feel excluded. This is the shift that providers of broadband need, and the state hopes for, if the technology is to be firmly embedded in the way we lead our lives.

NOTES

[1] Standage, 1998.

[2] This is an edited version of an article by MacDonald, 1978, 195-200.

[3] Levinson, 1997, 12.

[4] *Memorandum in support of the Expediency of the Telegraphic Communication of the Kingdom being placed in the hands of her Majesty's Government, June 1861.* Reports from Select Committees and other Reports on the Telegraph Acts Extension Bill and the reorganisation of the telegraph system with proceedings minutes of evidence appendices and index 1867-76, Irish University Press Series of British Parliamentary Papers, Shannon, 1971, 49-50.

[5] Kieve, 1973, 50.

[6] *A report to the Postmaster General upon certain proposals which have been made for transferring to the Post Office the control and management of the electric telegraph throughout the United Kingdom, July 1866.* Reports from Select Committees and other Reports on the Telegraph Acts Extension Bill and the reorganisation of the telegraph system with proceedings minutes of evidence appendices and index 1867-76, Irish University Press Series of British Parliamentary Papers, Shannon, 1971, 51-4.

[7] *A report to the Postmaster General...*, 1971.

[8] The Telegraph Act, 1868, Chap. 110, p 1.

[9] The Telegraph Act, 1869, Chap. 73, p 2. The six companies receiving compensation were The Electric and International Telegraph Company, the British and Irish Magnetic Telegraph Company Limited, Reuter's Telegram Company Limited, The United Kingdom Electric Telegraph Company Limited, The Universal Private Telegraph Company, The London and Provincial Telegraph Company Limited.

[10] Kieve, 1973, 178.

[11] *Report by Mr Scudamore on the Re-organization of the Telegraph System of the United Kingdom Presented to the House of Commons by Command of Her Majesty*, 1871, 18.

[12] *Inverness Advertiser and Ross-shire Chronicle*, 8 February 1870, 2.

[13] *Invergordon Times*, 31 August 1870, 2.

[14] *Inverness Advertiser and Ross-shire Chronicle*, 2 September 1870, 2. From its first edition containing telegraphed news on 8 February 1870, the *Inverness Advertiser* had complained in its articles of the late and uncertain supply of news, but from then onwards the paper contains telegraphed news of world events, particularly the Franco-Prussian War and events in the United States.

[15] *Report by Mr Scudamore on the Re-organization of the Telegraph System of the United Kingdom*, 1871, 17.

[16] *Report by Mr Scudamore...*, 1871.

[17] *The Telegraph and Telephone Journal*, January 1915, 79.

[18] Modernising the Highlands and Islands, *Post Office Telecommunications Journal,* Vol 127, 1975-76, 12.

[19] A Big Task for Scotland, *Post Office Telecommunications Journal*, Vol 19, 1967, 22.

[20] Modernising the Highlands and Islands, *Post Office Telecommunications Journal,* Vol 127, 1975-76, 12.

[21] What kids on Barra want: mobile masts, *Sunday Herald*, 14 December 2003.

[22] Islanders with the world at their fingertips, *Scotsman*, 6 May 1991. From the early 1990s, Highlands and Islands Enterprise in partnership with BT helped fund the establishment of 'telecrofts' to provide internet access and training to remote communities.

[23] *Connecting Scotland: Our Broadband Future*, August 2001, 4. [http://scotland.gov.uk/library5/government/csbc-pdf, 23 December 2004].

[24] *Connecting Scotland: Our Broadband Future: Making it Happen*, December 2002, iv. [http://scotland.gov.uk/library5/lifelong/csbf-pdf, 23 December 2004].

[25] Indian call centre plan raises fears for jobs in Scotland, *The Herald*, 12 February 2003.

[26] *Connecting Scotland: Our Broadband Future: Making it Happen*, December 2002, 20.

[27] The Scottish Executive has defined a community as the smallest geographical unit recognised by the Scottish Census, typically around fifty households.

[28] 'Broadband for Scotland – Extending broadband access to rural and remote Scotland' is being implemented under Section 53 of the Scotland Act 1998.

[29] Scottish Enterprise *Broadband for Business* Programme includes:
   1. The Neutral Broadband Website to provide independent advice on broadband provision.
   2. e-Business Demonstration Centres across the country.
   3. Corporate Demonstration Centres where large businesses can show the benefits of broadband.
   4. Rural Area Network pilot project in the Borders, using wireless technology to provide broadband connections.
   5. Power Line Trial using electricity power lines to deliver broadband.
   6. Wireless Excellence Network to develop wireless technologies.
   7. Community Broadband Trial in Ayrshire.
   8. Broadband for Farming Communities trial services.

[30] Levinson, 1997, 63.

[31] *Connected Communities: Broadband in the Western Isles*, February 2003. [http://www.connectedcommunities.co.uk/research/press/press2/, accessed 21 December 2004].

[32] http://www.connectedcommunities.co.uk/project/about/, accessed 26 May 2008

[33] The trial is being conducted by the telecommunications division of Scottish and Southern Energy plc in partnership with Scottish Enterprise and Highlands and Islands Enterprise.

[34] The Scottish Business Broadband Incentive Scheme offers grants to help with the costs of a satellite broadband link. http://www.ecommerce-scotland.org/sbbi/landing.asp

[35] Commission decision N307/2004 – United Kingdom Broadband in Scotland – remote and rural areas, 16 November 2004, para 38. [http://europa.eu.int/comm/secretariat_general/sgb/state_aids/comp-2004/n307-04.pdf, accessed 22 December 2004].

[36] [http://www.scotland.gov.uk/Topics/People/BroadbandforScotland/SEBroadbandInitiatives/LatestNewsAnnouncements, accessed 26 May 2008].

[37] *A Study into broadband reach in Scotland*, Mason Communications Ltd, 6, December 2006 [http://www.scotland.gov.uk/Publications/2006/12/20130045/0, accessed 23 May 2008].

[38] Mason, 2006,6.

[39] Baudrillard, J. *Symbolic Exchange and Death*, London, 1993, 18.

[40] *Scottish e-Business Survey 2004*, 15. [http://www.scottish-enterprise.com/publications/scottish_e-business_survey_2004_main_report.pdf, accessed 10 January 2005].

[41] Ofcom is the independent regulator and competition authority for the UK communications industries, with responsibilities across television, radio, telecommunications and wireless communications services.

[42] Ofcom Office of Communications The Communications Market 2008: Nations and Regions Scotland, 2008, 3. [accessed 6 June 2008 at http://www.ofcom.org.uk/research/cm/cmrnr08/scotland/]

[43] Rennie, F and Mason, R. *The Use of Computer Networks for Community and Business Development: A Study of the Potential of Broadband Internet Access for a Rural Population*, Lews Castle College, UHI Millennium Institute and Institute of Educational Technology, the Open University, February 2004.

[44] The Scottish Executive's *Pathfinder* projects, launched in autumn 2001, procured broadband services for the public sector in the Highlands and Islands and the south of Scotland. Initially for schools, health centres and council offices, access will spread to the rest of the community.

[45] *Scottish e-business survey 2004*, 15.

[46] Rheingold, H. *Smart Mobs: The Next Social Revolution*, Cambridge MA, 2002, 135

[47] Ascherson, N. *Stone Voices: The Search for Scotland*, London, 2002, 302.

SOURCES

Baldwin, F G C. *The History of the Telephone in the United Kingdom*, London, 1938.

Kieve, J L. *Electric Telegraph: A Social and Economic History*, Newton Abbot, 1973.

Levinson, P. *The Soft Edge: A Natural History and Future of the Information Revolution*, London, 1997.

MacDonald, D. Highland telegraphs, 1870-72, *The Post Office Electrical Engineers' Journal*, 71 (1978), 195-200.

Meyer, H R. *The British State Telegraphs: A Study of the Problems of a Large Body of Civil Servants in a Democracy*, London, 1907.

Rheingold, H. *Smart Mobs: The Next Social Revolution*, Cambridge MA, 2002.

Standage, T. *The Victorian Internet: The Remarkable Story of the Telegraph and the Nineteenth Century's Online Pioneers*, London, 1998.

http://www.connectedcommunities.co.uk

http://www.scottish-enterprise.com/broadband

TERMINOLOGY

512kbits per second: The speed of basic broadband provision in the UK.

ADSL: Asymmetric Digital Subscriber Line. ADSL is a technology for transmitting digital information at high bandwidths on existing phone lines.

Broadband: A telecommunication link to provide high speed access to the internet.

Copper wire: The network of copper telephone wires which connect a telephone exchange to the customer's premises. Copper wires can carry far less information than fibre optic connections.

e-: Shorthand for electronic, the prefix stands for any process which uses the internet to operate more quickly and efficiently.

Enabled/Enabling: Upgrading a telephone exchange or electricity substation with new technology to enable the existing technology to cope with the demands of broadband.

Fixed wireless network: Independent of the telephone line, this system connects to a network of radio repeater stations. The system benefits spread out communities where customers are not close enough to an enabled exchange or substation.

Fibre Optic/ High speed fibre link: A cable with a core of glass or plastic which carries pulses of light to transmit voice or data. Optical fibre carries far more information than conventional copper wire.

Infrastructure: The network of physical, wireless or satellite connectors which provides the means to access telegraph, telephone or broadband.

Lease line link: A telecommunication link leased from a telecommunication company by a business to connect parts of the operation in different locations.

Satellite: A system for very remote locations, it uses a dish to connect to broadband via a satellite. Since the system does not depend on proximity to any form of infrastructure, it can be used anywhere where there is an unobstructed line of sight to the south.

Service Provider: An organisation that provides access to broadband network to the customer.