Annex C Aims and results of example projects

This annex includes extracts from interviews with example project stakeholders, which describe the aims and results of example projects.

OnsNet, Nuenen, Netherlands

Aims: The initial aims of the investment stemmed from a local housing company's wish to install e-health style services, including video communications, in new-build homes for the elderly and disabled. The prices quoted by the incumbent for the services, however, were prohibitively expensive, leading to considerations of creating its own network. Also, the area had previously had ADSL and cable service available: the maximum speed was estimated to have been less than 10Mbit/s, and connections were viewed as expensive and with poor quality of service.

The key aim behind the funding given by the Ministry of Affairs was to achieve economic development as well as acting as a test of different technology and practices.

Results: The project is seen as a major success, with take-up of 85% in Nuenen and churn being almost non-existent. While there was no formal measure of increased gross value added (GVA), there was anecdotal evidence of increased entrepreneurship and a growing number of knowledge workers and high-tech industry entering the region due to the high level of connectivity.

Recent research[1] has been undertaken showing how the project has helped aid social cohesion among members of the co-operative.

Rural Development Programme, Sweden

Aims: This project fits into the aims of both Sweden's Rural Development Programme, as well as its National Broadband Strategy (NBS). The main objective of both of these programmes is to promote entrepreneurship, employment and help sustain Sweden's sparse rural population (with as few as two people per km^2 in some areas). Also broadband is seen as a basic service that all people should have access to.

Before the Rural Development Programme there was no real broadband investment in Sweden's rural areas, and although most areas had DSL quality was seen as a major issue. There was no market interest in the areas covered by the scheme, due both to lack of demand as well as the high cost of infrastructure given the terrain covered.

Results: Overall the project is seen as a success, with the number of applications for the grant money being much higher than anticipated. Following the project the government has redistributed an additional EUR15 million from the county administrative boards towards broadband projects. The counties have also applied to the government for more funding to try to meet the significant unfulfilled demand.

[1] Sadowski, B., Matzat, U. and Kwaaitaal, J., *Towards an integral vision on broadband in Eindhoven* (2008).

DORSAL, France

Aims: The aims of the investment were to tackle a market failure. Limousin (the second most rural region in France) was considered unattractive for telecoms services operators, and it was difficult for the region's only operator, France Telecom, to justify further investment. Prior to the deployment of the DORSAL network, prices in the region's main cities (e.g. Limoges) were much higher than in cities like Paris and Lyon, and services could only be provided to around 30% of end users. Also, certain enterprises were threatening to leave their local premises and move to another region, where telecoms services would be cheaper and have higher quality.

Results: Since the launch of the network, prices have fallen significantly (equivalent to levels in Paris), while quality has improved dramatically. Customers are now able to choose from a variety of operators. Individual end users now have access to triple-play services, and those who cannot be reached by ADSL can rely on WiMAX or satellite connectivity.

The investment had a positive impact on the local economy and job creation, as local telecoms operators have started offering retail services. Some local operators have expanded to other regions, while operators from other regions have also launched in Limousin.

Piemonte, Italy

Aims: The main aim of the investment was to increase broadband utilisation and availability throughout the region of Piemonte. In 2003/4, low broadband penetration was seen as a major problem with only 30% of the territory covered, equivalent to around 80% of the population. The incumbent had no commercial interest in the area, due to the mountainous and rural nature of the region.

Results: There is now 60% Internet penetration with only 2% of the population using narrowband services. The fact that 40% of the population is not using the Internet is attributed to the large elderly population, a fact which has led to the development of 'black-box solutions', especially for areas such as e-health, so that end users do not need to interact with PCs.

The project was seen as successful in working as a catalyst for investment by the incumbent, causing it to upgrade many of the exchanges. The Internet network is currently used by a range of vendors, telecoms operators and public organisations. The project was successful in involving the private sector early in the process, and so is viewed as helping the market rather than fighting it.

Midtsoenderjylland, Denmark

Aims: The goals of this investment were to create a 'networked community', to support public sector ICT services and start momentum behind the vision of 'fibre to all'. FTTH is seen as an important piece of infrastructure for economic and social development. Smaller towns had basic cable services, but most rural areas had almost no connectivity, and received only two airborne TV channels[2]. The municipalities asked the incumbent to consider deploying FTTH to rural areas of the region, but the incumbent concluded that there was no business case.

[2] Note: The most important driver for the investment was the very slow connections or lack of Internet access. There was no access to cable TV in rural areas, but the two airborne TV channels could be supplemented by satellite-based channels.

Results: In 2002, 90% of the population had access to broadband via copper but now 100% of the region has FTTH access, and around 50% of the population takes services. In rural areas this take-up increases to 80% due to lack of alternative ways to access TV content. The project has led to increased business development, including the creation of an 'Innovation House' which is home to 15 new companies. Since 2004 more than 50 new companies have been established and supported by the 'Innovation House'.

Syd Energi, the co-operative electricity company which rolled out much of the access network, has made calculations based on its investments and experience to date, and it expects to make a return on its investment (which provides FTTH connections to each of its 250 000 customers in the region) within 20 years.

North Karelia and "Broadband for all in Eastern and Northern Finland", Finland

Aims: The aims of both projects are to create increased economic value in a rural area of Finland. The projects aim to provide equal opportunities for rural and urban areas throughout Finland. The end goal is to increase the vitality of the countryside – with broadband seen as a key factor in the health of the region, especially given the connectivity requirements of both agriculture businesses and tourism.

The investment was further motivated by the lack of interest in these regions among telecoms operators. Prior to the North Karelia eRegio project, in 2008, 98% of the population had access to connectivity but in rural areas this mostly took the form of wireless connectivity (which was seen as slow and unreliable).

These projects also form part of the implementation of Finland's National Broadband Strategy (NBS).

Results: The original eRegio project increased the connection availability from 74% to 98% within the region; however, actual take-up was significantly lower. Although not complete, the new project has been very successful to date, with completed areas reporting take-up of around 60%.

It was felt too soon to have conclusive information on the creation of new businesses from the two projects. It was expected that the overall result will be a decline in businesses leaving the region (rather than getting new businesses to move to a rural region, which is quite difficult).

Digital Region, South Yorkshire, UK

Aims: Prior to the project the region had patchy ADSL coverage from local loop unbundling (LLU). The aim of the project was to provide FTTC connections to 80% of South Yorkshire and then use the revenues generated from to extend the scheme to provide 97% coverage. The Digital Region project included public investors with different aims: the regional development agency (Yorkshire Forward) was interested in the economic benefits that would arise from the project, while the Local Authorities had a greater focus on the social improvements, and the resulting transformation of the infrastructure available for public services. The commercial partner undertook the project to derive a financial return.

First-generation broadband was already available in most of the area, but the project aimed to bring a step change into the region to kick start the local economy. At the start of the project the view from commercial operators was that there was no commercial case for next-generation broadband in the region.

Results: Network build is ongoing, having started in 2009. Project planning started in 2004, and there was a long time prebuild period due to procurement difficulties, and a change of partnership structure that required additional due diligence before the project could start. Because of this time delay, BT has deployed an FTTC network in similar locations to those covered by the Digital Region infrastructure.

To date, Digital Region has struggled with customer acquisition, especially following competition from other infrastructure operators. The network is slowly picking up new customers but currently lacks the major providers, as they are able to integrate into BT's competing network much more easily.

RAIN project, Lithuania

Aims: An advanced broadband network is seen as necessary for Lithuania's population to use ICT and access content, and to allow businesses to develop and become more competitive. Currently rural areas (32% penetration) are far behind urban areas (99% penetration) in network connectivity. The rural areas have received little private investment in the last five years due to their commercial unattractiveness (due to low subscriber density), creating a digital divide.

The RAIN project aims to provide opportunities for residents, public institutions and businesses to use broadband in the country's rural areas. It has three socio-economic goals:

1. Reduction of Lithuania's digital divide by creating favourable broadband infrastructure conditions throughout the whole country, including areas that are unattractive to businesses.

2. Promotion of competition in the broadband sector. An open-access policy will directly contribute to competition and development of new business opportunities, and contribute to making infrastructure more economically efficient.

3. Acceleration of the development of an information society in Lithuania. The creation of advanced infrastructure in areas that currently do not have it will help to provide access to broadband networks for public institutions.

The infrastructure built helps in meeting the goals of both the Lithuanian Broadband Communications Infrastructure Development Strategy for 2005–2010 and the Information Society for All component of the Economic Growth Action Programme. Once the project is finished, it is hoped that favourable conditions will have been created in rural areas of the country for:

1. People to use e-services and access content, as well as work and study on distance programmes; giving the opportunity for Lithuanians to acquire knowledge, skills and qualifications to adapt to rapidly changing living and working conditions.

2. Businesses to use ICT in their operations, thus a creating a positive environment for IT businesses as well as increasing the level of productiveness by creating favourable conditions for innovation and SMEs.

3. Public institutions to modernise their activities and provide e-services, contributing to developing the use of IT to increase the efficiency of the decisions taken by public institutions.

Indicator (unit of assessment)	*Current level*	*Goals for 2015*
Increase broadband network service users penetration	72% (2005)	+23%
Connected towns and villages to the created broadband network	430 (2005)	770

Figure C.1: Summary of RAIN project goals [Source: information from stakeholder]

Results: Project implementation is ongoing (it is planned to finish by March 2013). The progress of the project is being monitored and all project activities so far have been done on time.

Auvergne, France

Aims: The overall aim of the network was to guarantee that 100% of households have access to high-speed broadband (with a minimum speed of 512kbit/s). It aims to cover the white areas[3] (4% of the territory and 353 communes) in which affordable and efficient Internet access (minimum 512kbit/s) was unavailable.

High-speed broadband access constitutes a decisive factor in the competitiveness of territories. The network aimed to deliver a number of economic, social and territorial goals:

– build up an innovative knowledge society and strengthen economic competitiveness
– attract new residents and businesses (newcomers check ADSL broadband eligibility before their installation), maintain the presence of those already settled
– avoid the digital divide between rural and metropolitan areas by bringing high-speed broadband access in the rural areas and preserve the coherence between territories
– bringing new services for leisure, family life, and professional use.

In those areas which are sparsely populated, private operators in telecommunications are not ready to invest. The deployment and operation of infrastructure, and the commercialisation of High-Speed broadband services would not be profitable for them.

Results: The impacts of the project are:

– *Development of the broadband market:* 99.6% of the 14 000 lines targeted benefited from an increased speed beyond the minimum 512kbit/s. Beyond the 14 000 lines targeted, 35 000 lines benefited from an increased speed. One month after the deployment of these new facilities, around 30% of the households that previously did not have a high-speed broadband Internet access, subscribed to a contract

– *Development of new service offers and economic impact:* small businesses can start more easily; agricultural holdings are connected and can improve their organisation and use the online declaration for Common Agricultural Policy subsidies; the work of independent nurses is facilitated through the use of online services; 103 interactive terminals of Visio-Public Points device (PVPs) are spread across rural areas to facilitate access to public services; Numeric Spaces of Work (ENTs) are developed in schools and can improve relationships between parents, pupils and teachers.

STOKAB, Sweden

Aims: The company STOKAB was started in 1994 following deregulation of the telecoms market. The company was started when no operator showed any interest in dark fibre in Stockholm, but the municipality felt there was a commercial need for it. The city wanted good IT infrastructure to help contribute to growth, and so formed STOKAB, a company 100% owned by the municipality. It was felt important that the broadband infrastructure and services were split in order to fully promote competition.

Results: One indication of success is the price of Internet access throughout Stockholm. A recent publication, ”Computer Sweden” marked the price of 100Mbit/s broadband in Stockholm at EUR550 (compared to an average of EUR950 for the rest of Sweden). This is helped by the 90+ service providers in Stockholm, which is much more than in most other cities in the EU.

[3] The EC makes a distinction between areas where no broadband infrastructure exists or is unlikely to be developed in the near term (white areas), areas where only one broadband network operator is present (grey areas), and areas where at least two or more broadband network providers are present (black areas).

In total STOKAB has over 800 business customers. The first of these customers came from banks and finance houses who wished to control their own networks.

One of the key success factors was that STOKAB did not try to compete with its customers. STOKAB maintained this role to promote stability for its customers.

Between 1994 and 2008 the total investment amounted to approximately EUR300 million, but between 2009 and 2012 the rate of investment has increased to EUR150 million per annum. This has mostly been driven by the move to FTTH, which has higher costs. So far, 250 000 households have been connected (which will rise to 400 000 by 2012) and 100% of business premises.

Lombardia, Italy

Aims: The main aims of Progetto BUL (Banda Ultra Larga, meaning 'ultra-broadband') Lombardia (Progetto Lombardia) are linked to the offering of new services to homes and businesses through a more capable network. The services which are of interest to the Lombardia region include:

– services related to digital public administration and "digital democracy"
– digital healthcare and telemedicine
– digital school and professional education through e-learning
– digital justice and safety
– intelligent transportation systems and digital logistics
– teleworking and digital collaboration
– software as a service (SaaS) services and cloud computing for enterprises
– smart grid and energy efficiencies
– tourism.

Regarding infrastructure targets, the project aims to bring FTTH to 50% of population of Lombardia. The Milan municipality is excluded (as it has already been passed).

Expected results: Results in terms of penetration will depend on the treatment of the existing copper network. The following figures are based on estimates from the Lombardia region:

– if there is a complete total switch-off of the copper network, penetration of the new infrastructure should reach about 100% of the population in the 167 served municipalities
– if the copper network is left in situ (an overlay scenario), the new infrastructure should have a population penetration of about 60% in the 167 served municipalities.

Implementation is expected to begin by mid-2012 and to be completed by 2015 (the Expo year in Milan).

Alto Adige, Italy

Aims: Deployment of the fibre network is in response to requests made to the public administration by several businesses and end users that are seeking broadband connectivity in the region. Regarding business entities, there are very many hotels in the area have been considered as business entities due to the high level of employment they provide and their importance for tourism in the region.

The broadband project defined coverage targets, including: all businesses employing three or more people, 95% of those with fewer than three employees and 90% of the population. Its objective is also to cover all the 116 local municipalities in the Alto Adige sub-region. Initially each city hall is being connected (primary network), and then the main public institutions will be connected (secondary network) (i.e. schools, libraries, hospitals, sites for transmission of signals, etc.).

Before 2004, broadband coverage in the Alto Adige sub-region was the responsibility of the single telecoms operator providing services in that area. This meant that broadband coverage in a certain area was influenced by the return on investment that the operator sought for that specific investment. Thus the Alto Adige sub-region had fibre solutions provided by the Italian incumbent operator and other local telephone operators only in the Bolzano city (the 'capital' of the sub-region). All other local municipalities were not covered by the high-speed fibre broadband connectivity.

Results: Both the wireless and wireline aspects of the project are considered to have been a success and have met all of their targets.

The local Council could have invested slightly more and earlier in order to avoid having to work to an even tighter deadline than the one originally set (i.e. 2013).

Annex D Infrastructure choices from example projects

This annex includes extracts from interviews with project stakeholders, which describe the infrastructure choices from example projects.

D.1 FTTH

OnsNet, Nuenen, Netherlands

For the OnsNet project, FTTH was chosen, with two fibres laid to each house (one delivering Internet and the other TV). FTTH was considered to be the ideal choice to deliver e-health style services, including video communications, in new-build homes for the elderly and disabled.

Although FTTC was estimated as EUR200 cheaper per house than FTTH, the co-operative was described as wanting the 'best of the best', in terms of service, rather than focusing on cost.

Rural Development Programme, Sweden

The project requirements were technologically neutral but the choice of fibre is indirectly driven by the 2020 broadband aims of the Digital Agenda for Europe. Sweden's broadband goals include two key aims: by 2020, 90% of Sweden is to have 100Mbit/s broadband; and by 2020, the whole population is to have at least basic broadband access. The choice of fibre is seen as the only way to achieve the first of these goals.

Due to being primarily awarded to local co-operatives, the money given tended to fund access networks rather than core network projects, although this was not specified as a formal criterion. This was mainly because local groups tend to be more interested in projects that have an immediate and direct effect on end users.

Midtsoenderjylland, Denmark

A consultant was commissioned to analyse the difference between installing a WiMAX network and a fibre network in a rural area (65km, 500 termination points). The conclusion of this work was that the WiMAX would initially be cheaper, but that there was an eight-year breakeven point for the fibre network, given the extra revenue for operators due to opportunities to sell services such as TV.

In addition to supporting public sector ICT services, another aim of this project was to start momentum behind the vision of 'fibre to all'. FTTH is seen as an important aspect of infrastructure for development. In the smaller towns there were basic cable services, but most rural areas had almost no connectivity (for example, receiving only two airborne TV channels). At the start of the project the municipalities were also advised by Aalborg University that symmetrical connections would be more useful in the future than asymmetrical.

Following the installation of a core ring between several city halls, discussions were held with Syd Energi, which felt that if it could supply electricity to rural areas it could just as easily supply FTTH. A large storm in 1999 had destroyed a large portion of Denmark's overground electricity network, meaning that local electricity companies were slowly migrating much of their electricity network underground. This gave Syd Energi a good opportunity to install FTTH at the same time as it installed the new electricity cables. To operate this network it agreed to rent the backbone of its network from the municipalities.

A point-to-point network was installed, inspired by projects in Sweden, as GPON was felt to limit different service providers, and the benefits of point to point were felt to outweigh the additional costs.

eRegio, North Karelia, Finland

Following the eRegio project which looked at basic broadband provision (2005–2008), a new project has been started with a greater focus on providing high-speed broadband, "Broadband for all in Eastern and Northern Finland".

Both of these projects form part of the implementation of Finland's National Broadband Strategy (NBS). The NBS has two key parts: since summer 2010 Finland has had a universal broadband service obligation (1Mbit/s) in place (supported by the eRegio project, and similar projects in other regions); the second part consists of a high-speed broadband strategy (the key driver of the new project), which requires 100Mbit/s by 2015 for all the population. To date all implementations have included fibre in the access network despite the projects being technologically neutral, due to the 100Mbit/s requirement in the NBS.

STOKAB, Sweden

STOKAB was set up in 1994, well before fibre had become a mainstream access network method. The decision to go with fibre was influenced by the presence in Stockholm of Ericsson (one of the world's main fibre developers at the time). The city also wanted to minimise digging in the future, and felt that fibre was future proof.

One of the main lessons that had been learned was the difficulty of starting out at such an early stage of a new technology. It was also felt that it was important to install a sufficient number of fibres. STOKAB started out installing 48 fibres (a number that most people felt was too high at the time), but is now having to upgrade some areas to as many as 684 fibres.

Lombardia, Italy

The network will provide FTTH and will be characterised by a hybrid GPON and P2P infrastructure: this actually reflects operators' implicit preferences regarding network infrastructure, as the incumbent (Telecom Italia) prefers the GPON architecture while other OLOs show a preference for the P2P architecture.

Two different scenarios have been developed for the precise make-up of the network architecture:

– *base case*: whereby GPON is the prevalent access technology, with P2P links only if/where required (i.e. significant businesses)
– *evolutionary case*: whereby a higher number of end users have a dedicated fibre from the local termination point.

In both cases access to the network is provided by the relevant SPV at the request of operators; the SPV maintains access ownership and provides access to operators on a client basis. In fact the two scenarios are not alternatives, but the second one can be seen as an evolution of the first.

Progetto Lombardia also plans to optimise the project by carrying out civil works together with other works conducted by third parties, by using existing infrastructure that is able to host the network (e.g. public lighting, district heating and sewer networks) and by minimising charges from road surface repairs.

D.2 FTTC

Digital Region, South Yorkshire, UK

The Digital Region project features a deployment of FTTC infrastructure to 80% of homes in the region (representing 546 000 homes and 40 000 businesses).

The original tender requirements were technology neutral, but set out requirements for a certain level of speed and quality of service. Research was published about the difference that high-quality, fast broadband would make to South Yorkshire. The original requirement was guaranteed 25Mbit/s service to everyone, but following talks with industry this target was changed to 40Mbit/s.

FTTC was seen as a cost-effective way of delivering the required service level. The Managing Authority did not receive any tenders which proposed an FTTH solution as the cost was considered to be too high.

Auvergne, France

The project includes the deployment of two types of passive infrastructure:

– a “very little technical site” (in French “Très Petit Site Technique”, TPST) between the Main Distribution Frames and the end users. A TPST consist of an existing building, shelter or cabinet connected to the local cabinet and converted in order to accommodate the DSLAM of another operator.
– optical fibre (860km) between the Main Distribution Frames and the “very little technical sites”.

The winning technology was “NRA-ZO” (Subscriber Node for eligibility improvement), which appeared during the competitive dialogue and was chosen as the technically and economically most advantageous technology. This technology has been available since June 2007, when it was approved by the ARCEP. It is a well proven technology, based on commonly known standards and already deployed on a large scale. It will also support further evolution of the network and speed increases thanks to a further fibre deployment.

The infrastructure is open to competition. The Contractor operates and commercialises the infrastructure, and also acts as an Internet access provider. Alternative operators can rent active infrastructure from the Contractor (i.e. use the Contractor’s DSLAM via bitstream access technology), or they can rent passive infrastructure (i.e. space in a “very little technical site” in order to install their own DSLAM). The end user therefore has a choice of Internet provider.

The cabinets have been built to house two DSLAMs: one from the Contractor and one from an alternative operator. This is sufficient to meet current market demand. If further operators want to install their own DSLAM, the Auvergne region will finance an enlargement of the cabinet.

D.3 Wireless and satellite

DORSAL, France

Due to the fact that Limousin is a rather mountainous region, WiMAX is used to provide coverage in locations where no other Internet access was available. Although the current network uses 72 WiMAX transmitters, WiMAX does not provide coverage of the entire region. End users who cannot receive connectivity through the network receive a subsidy for the equipment installation costs to connect to a satellite Internet provider.

Initially 40 transmitters were planned for deployment, but as these did not provide sufficient coverage as specified in the contract terms, the network operator Axion/Sogetrel was obliged to deploy another 32 transmitters, with this extra investment fully financed by the network operator.

For the WiMAX part of the network, Axion/Sogetrel collaborated with mobile operators and public bodies such as the French Defence Ministry which own towers in order to obtain rights of use. Where possible, WiMAX equipment was installed on existing towers. Such collaborations were envisioned in the terms of reference and mentioned by applicants in their proposals. These external relations and collaborations were managed by Axion/Sogetrel as specified by the DSP framework[4].

Piemonte, Italy

Prior to 2005, strict regulation of wireless networks in Italy did not allow commercial networks to use free frequencies to provide services to the general population. However, the market was stimulated by investment exclusively in public sector services, leading to a change in wireless regulations in late 2005.

Once the regulations changed, many wireless network managers expanded into the private sector through their existing networks and the experience they had gained from the public network. However, the majority of operators are still small and cautious, with the largest having only 10 000 customers and most being in the 500–1000 customer range.

The bands used were mostly 2.4 and 5GHz unlicensed bands, although nowadays 17GHz is also used because of frequency congestion in some areas. Some of the largest wireless operators are using licensed links in the backhaul network to guarantee bandwidth to customers. It should be noted that wireless offers are coming very close to ADSL download speeds (with much more upload bandwidth than ADSL).

Alto Adige, Italy

The broadband project includes a wireless network to provide services to homes, and a fibre network for services to business and public buildings.

[4] The investment was executed under the framework of délégation de service public (DSP), a model set by French law under which a private actor is granted the opportunity to manage public services by a public body. The contract is usually set in a manner which establishes a link between the quality/outcome of management and the remuneration of the actor. This model is commonly used for the management of public services such as transportation, water, electricity and others. The framework enables local collectives to formulate provisional contract, with defined quality/outcome requirements, which serves as basis for negotiations and execute a public tender procedure through which they select a partner.

Wireless services were provided to 90% of the population by 2009. Wireless technology was chosen due to its ability to provide coverage quickly to the sparsely populated areas of mountainous terrain.

D.4 DSL (copper-based) broadband technology

Piemonte, Italy

Between 2004 and 2009 the project received a continuous stream of investment, but some areas are still only at 1Mbit/s. An agreement has been made with Department of Commerce to undertake further upgrades in the future. It is felt that a FTTH network is still not really needed due to a lack of services that would use it; also there is a lack of available public money to fund it.

DORSAL, France

The network choice was determined by DORSAL's ambition to deploy a network which was extensive in terms of coverage, open and attractive to all network operators, and used future-oriented technology. The network needed to be compatible with the technology used by different operators. It combined 1200km of fibre-optic backbone with ADSL used to provide broadband services to end users over the copper infrastructure.

The initial speed needs estimated in 2004, and for which the network was designed, were a minimum of 10Mbit/s symmetrical for enterprises and a minimum 1Mbit/s asymmetrical for end users. However, due to the rapid developments in technology, the speed requirements are now much higher. Following an upgrade, the network currently provides triple-play services with 20Mbit/s over ADSL. Any future upgrade to FTTH is felt to be difficult due to the nature of the DSP framework (see below). Any future project is thought to potentially require substantial funds, including EU grants.

D.5 Core and backhaul

OnsNet Nuenen, Netherlands

Backhaul was laid from Nuenen to an Internet exchange point at the University of Eindhoven just 7km away. The cost was approximately EUR200 000 to build the backhaul and a POP to serve 7000 connections. The project was seen as both a good investment per house and, given the high take-up rate of the Nuenen project, the backhaul investment per house was seen as relatively low.

DORSAL, France

The network choice was determined by DORSAL's ambition to deploy a network which was extensive in terms of coverage, open and attractive to all operators, and used future-oriented technology. The network needed to be compatible with the technology used by different operators.

The choice of network architecture was influenced by the fact that Limousin is a very rural and mountainous area, thus the actual network deployed features from a variety of technologies, all supported by 1200km of fibre-optic backbone.

Midtsoenderjylland, Denmark

In 2003, an opportunity arose when four municipalities (including Vejen) decided to collect their ICT together into a centralised hub. To do this required a fibre connection between the four city halls, but the incumbent quoted a high price to provide this and the municipalities decided to create the network themselves.

In the end a 48-fibre optical ring was designed, linking the four city halls and various other large institutions. The 48 fibres gave extra capacity for the future, and allowed spare dark fibre to be rented out.

The municipalities paid for two rings (the second of which was built in 2006 before the reorganisation of municipalities), which were owned and operated by the municipalities for their own use. Attached to these rings are two FTTH networks, built and owned by two separate electricity companies (across two different regions).

eRegio, North Karelia, Finland

Public funding is provided to a telecoms operator as a grant for it to build the core infrastructure. The backbone it builds has to reach within 2km of each house, with the last-mile access being financed by individual households (in reality the backbone passes within around 100–300m of each household).

Piemonte, Italy

The project featured two major investments in core network infrastructure: a regional backbone was created connecting major cities, and a new Internet exchange was created to be run by a public/private consortium. It was identified that an upgrade to the backbone would be the most effective use of funds in terms of delivering a useful increase in bandwidth to end users. Previously the closest Internet exchange was in Milan, and had to be accessed across multiple telecoms operators (who had no interest in making the access easy).

The backbone is split into two key parts: the public sector part is operated by CSI (the local public ICT administration organisation), while the private sector part is operated by the not-for-profit exchange consortium which included public and private members.

In order to fully distribute the network, nodes were spread across multiple cities – which was felt to be very useful for smaller operators. The project also increased competition by allowing smaller operators to obtain bandwidth on the same terms (price and non-price terms) as larger players.

RAIN project, Lithuania

Across most of Lithuania there is sufficient last-mile infrastructure for broadband, but the necessary core/backhaul network infrastructure and capacity are missing.

The network is to adhere to principles of: open access, technological neutrality and promoting competition. The infrastructure is to be built only in rural areas and where it does not already exist. The technical solutions chosen provide for the relevant needs for no less than ten years.

The goal of the RAIN network is to promote the use of broadband communications in rural areas. Whilst preparing the project, the following alternative techno-economic aspects were analysed:

I. Transmission medium: fibre-optic cables; copper cables; wireless technologies
II. Data transfer solutions: MPLS technology to be used in the entire network; MPLS technology to be used on the network distribution levels; Ethernet technology to be used in the entire network
III. Asset management systems: multiple (up to ten) operators of the RAIN network; one operator of the RAIN network (PEPI); one operator of the RAIN network (a private enterprise).

The following economic alternatives were also analysed: development of the RAIN network not to be implemented; network development to be implemented by creating only the transmission medium; network development to be implemented by creating the transmission medium and installing data transfer solutions.

Due to the wide geographical coverage, the types of service to be provided and the large number of users, high standards of reliability and speed were required. In addition, the infrastructure that is built has to remain in service for a minimum of ten years and be technology-neutral to allow as many technologies as possible to compete in the market. This is to give service providers a free choice of technology while still being able to compete in providing services. It should be noted that the RAIN project did not involve the creation of a whole new network but rather the creation of missing parts of the current networks. Given the ideal of the network allowing everyone to use it who wishes to do so, it is important that the connection capacity is sufficient with the possibility of future expansion, and that there are enough resources for all providers.

Whilst carrying out a survey of the providers about the resources they need, it was determined that the most acceptable solution was fibre. Since not one, but several, providers plan to use the same communications channel at the same time, and they plan to use different technologies, a medium is needed that provides sufficient resources for all the operators and is suitable for any technology. Fibre-optic cable was chosen as the most acceptable solution. Given the number of potential operators it was decided that no fewer than 24 fibre cables were to be used in principal links and no fewer than 12 fibre cables in inputs of network objects.

The infrastructure created during the project did not include the last-mile segment of the network. The infrastructure allowed the connection to the network of last-mile segments using all types of technological solution without modifying the network. The infrastructure aimed to encourage operators to provide broadband to end users, attracting investment of private capital into access infrastructure in rural areas and promoting competition. The infrastructure created during the project gives communications operators the opportunity to provide broadband communications services and allows users to freely choose a service provider in at least 98% of the country's rural areas.

Alto Adige, Italy

The broadband project includes a wireless network to provide services to homes, and a fibre network for services to business and public buildings.

Fibre services are being targeted at all businesses employing three or more people, and 95% of those with fewer than three employees. However, the network is being prioritised to connect city halls first (primary network), and then to connect the main public institutions (secondary network) (i.e. schools, libraries, hospitals, sites for transmission of signals etc.).

There are a significant number of local utility companies (i.e. district heating companies, power stations, etc.) which had previously laid fibre from their local exchange stations to the residential and business premises, therefore allowing the telecoms operators to rent their fibres and easily provide connectivity to their customers. These entities will be valuable to the project, as through the civil works they undergo to renew or extend their infrastructure, they are easing the completion of the entire fibre network roll-out, in terms of both time saved and investment reduced (for instance, when the civil works are used both to meet the needs of these entities and to lay more or new fibre).

Annex E Investment models used in example projects

This annex includes extracts from interviews with project stakeholders, which describe the investment models used in example projects.

E.1 Bottom-up models

OnsNet, Nuenen, Netherlands

The Nuenen project was started through the creation of the Nuenen Internet co-operative, where members were given the opportunity for an FTTH connection. It was considered advantageous for local citizens if the Internet was to be turned into a utility – with ownership falling on either the government or the local population itself.

Following a six-week demand aggregation programme, an independent local co-operative was created to build and own the network, and a business plan submitted to the Ministry of Affairs. By the end of the six-week period around 90% of the area's population had joined the co-operative. The co-operative supplied its members with free triple-play broadband for the first year, followed by a charge of EUR60 per month thereafter. The network was operational after five months and following the first year's free period 80–85% of the citizens continued to use the service. In addition, recent research has shown how this project has helped aid social cohesion throughout the co-operative's members.

Due to the co-operative's lack of expertise it decided to outsource both the building and operation of the network. A turnkey solution was required for building the network, and a construction company was chosen that offered this. For network operation, the co-operative undertook an outsourcing arrangement with Edutel, an existing semi-public telecoms operator affiliated with a number of high schools in the area.

Many of the technological choices were driven by the co-operative's aims of achieving 'the best of the best', and supported by the co-operative investment model being able to take a longer-term view of benefits rather than just focusing on a short-term business case and the reduction of costs.

Rural Development Programme, Sweden

Under the Rural Development Programme in Sweden, a typical local investment project was initiated by residents and enterprises showing interest and forming into co-operatives or economic associations. These organisations applied to the local authority (county board) for support, and contributed either financial support or support in kind (often digging to install new ducts). While the private contribution was non-compulsory, a public grant was more likely to be awarded if interest in local investment was demonstrated. Due to this additional investment, a local model was seen as a good way to scale up the initial investment. The public money given to these projects was made up of 75% EU funding and 25% other public funding.

An advantage of the co-operative structure was that one of the key cost-saving elements came from easier access to private land, due to the local initiative and investment in the project. However, it was agreed that one of the downsides of allowing grant money to be directed through local interests was that less organised or more sparsely populated rural areas may miss out on grants, and that those networks that were built may not have common technical standards. This was not seen as a major problem, however, and it was felt more important to ensure the money was going to an entrepreneurial region with proven demand.

The grants tended to fund access networks rather than core networks, as local groups tended to be interested in projects that offered an appreciable benefit to end users. In the majority of cases the local group owns the resultant infrastructure, but occasionally the local group was allowed to sell the infrastructure to a third party (though specific market mechanisms had to be used to ensure a fair price). The network itself was run by an independent telecoms operator as a condition of the grant being awarded.

Another important part of this project was the partnership between the regulator and a non-telecoms department: the project was the first to involve co-operation between the Board of Agriculture and the Swedish postal and telecoms regulator (PTS), with PTS helping to design the scheme and the Board of Agriculture undertaking marketing and information. This enabled the Board of Agriculture's rural expertise to be complemented by the PTS's expertise in broadband. The actual implementation was done regionally by the County Administrative Boards, who allocated the money to the local co-operatives.

eRegio, North Karelia, Finland

A bottom-up approach features in the composite funding model of this example project. Public funding is given to a telecoms operator as a grant for it to build the core infrastructure (i.e. a private DBO approach, as explained in the next section). However, the backbone that is built has to reach within 2km of each house, with the last-mile access being financed by individual households (i.e. a bottom-up approach, and in reality the distance to the backbone is much less). Each household signs an agreement, and provides payment, at the time of the project initiation so that all the fibre can be laid at the same time. It was highlighted that a key driver of people signing up was being able to see the construction happening outside their houses, and the additional incentive was that while houses are able to buy access after the project has finished it will cost them significantly more.

An improvement to the model has been implemented in the successor project, "Broadband for all in Eastern and Northern Finland". In the new project, surveys are run to check the demand before construction starts in each area. However, as only price estimates can be used to gauge demand, the response may vary from reality given variance of the actual price. The real demand is only realised once the project is underway, with the 'excavators on the ground' effect that was highlighted above.

E.2 Private DBO model

eRegio, North Karelia, and "Broadband for all in Eastern and Northern Finland", Finland

A private DBO approach features in the composite funding model of this example project. Public funding is given to a telecoms operator as a grant for it to build the core infrastructure. However, the backbone that is built has to reach within 2km of each house, with the last-mile access being financed by individual households (i.e. a bottom-up approach, as explained in the previous section).

The ongoing “Broadband for all in Eastern and Northern Finland” project was launched to create demand, and give information and manage/co-ordinate the broadband promotion and operations between neighbouring regions in eastern and northern Finland. This project receives funding for its high-speed broadband investments from the Finnish government and EU agriculture funding. The Finnish government has reserved EUR66 million of State aid, and EUR25 million will be received from the EU (agriculture funding) for the whole of Finland. The basic financing model is that around one third of the funding is State or EU aid, another third comes from a local municipal fund, and the final third is from the telecoms operator that is building the network. Municipalities have to pay 8%, 22% or 33% of the cost of their investments, depending on their financial capacity and according to criteria defined by the government. The predecessor project, eRegio, used the ERDF mechanism for investment projects that were launched while it was underway. In most cases half of the finance came from the municipality and half from the ERDF, although investment was sometimes also received from private telecoms operators. All normal State aid rules were followed, with Finland having to notify the EU of the model being used.

For the “Broadband for all in Eastern and Northern Finland” project, the Regional Council gave the permit for the grant money through a public procurement which followed appropriate EU procurement regulations. The overall project was divided into relatively small lots (1–3 lots per municipality for each of the 14 municipalities under Regional Council of North Karelia). This was due to smaller lots being seen as easier to manage and also a way of keeping the lots relatively inexpensive, to allow smaller operators the chance to bid.

In the case of the eRegio project, 11 lots were offered, but the only bids received were from a single local telecoms operator (a similar situation was seen across the rest of Finland’s projects). The national telecoms operators were not interested in the rural projects despite the available funding, and this led to a lack of competition in the process. It was felt that local telecoms operators are more willing to wait longer for payback (as their focus is on maintaining their reputation among the local population, rather than on meeting the needs of shareholders), so will apply for grants that the national players are not interested in.

Due to the problems with lack of competition, the Regional Council is now looking at the option of awarding grants to local co-operatives (made up of local residents and businesses) to fund the backbone network (and so effectively make the entire project bottom up). The co-operative would build and own the network and make an agreement with a telecoms operator to operate it.

The telecoms company that wins each project has to provide a guaranteed 30 years of service on the network. One of the Regional Council’s jobs, together with the municipalities, is to check that the network is running in accordance with the agreement, though it has no specific tools to use in this task. The majority of monitoring comes through customer feedback. When problems are highlighted, a flag is raised with the Finnish regulator (FICORA) to apply penalties.

E.3 Public outsourcing

DORSAL, France

This project was among the very first of its kind, whereby a group of local authorities formed a territorial collective to invest in deploying a network. In March 2002, the syndicate know as DORSAL was formed, representing a number of French ‘départements’ (regional sub-units) and larger regional cities. Following DORSAL’s initial examination of the prospects for financing and deploying a regional network, several more départements joined the syndicate which then launched the project execution phase.

DORSAL decided to execute the project under a public outsourcing framework called a délégation de service public (DSP)[5]. It would then arrange a concession of the public service, enabling it to benefit from private investment, attain greater economic efficiency and benefit from the experience of collaborating with a specialist enterprise. The DSP framework enables local collectives to formulate a provisional contract with defined quality/outcome requirements, which serves as a basis for negotiations, and execute a public tender procedure through which they select a partner. This framework also transfers risk from the collective of public bodies to the private partner.

After three months of discussions, Axion/Sogetrel was unanimously selected to deploy the network and manage the service for a period of 20 years. The DORSAL network was conceived as a wholesale network, with Axion/Sogetrel providing only wholesale, rather than retail, services. The network currently provides connectivity to 20 operators, including France Telecom. Overall, 45% of the investment was made with public funds, with the remaining 55% funded by the partner.

The management and ownership model was decided under the framework of DSP. The concession is given for 20 years during which all revenues from operating the network go to the private partner. The partner has an obligation to maintain the network. At the end of the 20-year period, the network becomes the property of the territorial collectives syndicate. At this point a new procedure to select a partner will be initiated, but the collectives will set the contract so as to receive a share of the revenues. DSP also ensures that DORSAL is updated monthly by Axion/Sogetrel, with DORSAL publishing an annual report which captures all the activity on the project.

One of the key lessons taken from this project was the feeling that having a collective call for proposals facilitated the establishment of economies of scale, as selecting a single candidate to deploy an inter-departmental network reduced the cost for the départements and cities which are part of DORSAL. If each had undertaken the process on its own, it was felt the total cost would have been greater.

In addition, it was felt that the public outsourcing model worked well here given the reliable private partner and local structures capable of organising themselves and representing the collective interest. It was felt that Internet connectivity is a public good and the public should be able to have control over it.

A problem highlighted is that the current contract terms for a DSP framework, as set by French law, do not allow for re-investment of funds which represent more than 20% of the value of the initial capital, over the term of the contract (20 years in this case). For the telecoms sector, which is capital intensive and features rapidly evolving technologies, this amount may well be insufficient. For example, if FTTH is to be rolled out in the future, 20% (EUR17 million) of the initial investment of EUR85 million would be inadequate for any deployment at scale. Any future project is thought to potentially require substantial funds, including EU grants.

Auvergne, France

The chosen model is a public–private partnership between the Auvergne Regional Council and a private operator (the Contractor). The Auvergne Region provides the funding for the required infrastructures (EUR38.5 million from the Region, the départements, the French State and the ERDF) through an income provided to the operator during the ten-year contract period. The operator designs, operates and commercialises the infrastructures on behalf of the Auvergne Regional Council. The Region Auvergne owns all the infrastructure deployed.

A PPP appeared to be the best solution for legal, economic and technological reasons:

5 A délégation de service public (DSP) is a legal model in French law under which a private actor is granted the opportunity to manage public services by a public body. The contract is usually set in a manner which establishes a link between the quality/outcome of management and the remuneration of the actor. This model is commonly used for the management of public services such as transportation, water, electricity, etc.

– the market failure (lack of private operator's investments in these sparsely populated areas) called for a public intervention

– the Region was unable to define the technical means that could meet its needs, and could not establish the legal and financial parts of the project construction. It fell to the Contractor to recommend a comprehensive technological, economic and financial solution. Thus, the Region would benefit from private sector innovations

– only a PPP would enable both a speedy selection process for the Contractor, and income for the Contractor in zones where the return on investment is too weak (because of low population density)

– the PPP allows a sharing of the risk. The Contractor take on a part of risk and responsibility, especially in terms of technical exploitation.

The timetable for the project was as follows:

– an agreement was signed in December 2005 between the Auvergne Regional Council and the four departments of the territory; a preliminary study concluded that a PPP was the best solution

– a competitive dialogue was led by the Region between January and July 2007

– the PPP contract with the Contractor (France Telecom) was signed in October 2007. The contract transferred the Contracting Authority to the Contractor

– the project was deployed by the Contractor, under the supervisory control of the Region

– the deployment was completed in March 2009.

The State aid regulation did not cause any problems. The French Regulatory Authority for Electronic Communication and Posts (ARCEP) approved the technical solutions.

The Contractor operates the infrastructure for a ten-year period on behalf of the Auvergne Region, both technically and commercially. It receives an income from the Auvergne Regional Council covering its investment and operating costs. Thus, the role of the Contractor is to design, finance, build, technically operate and commercialise the infrastructure. The Contractor also acts as an Internet access provider alongside other potential providers.

The Auvergne Regional Council is the Managing Authority; it defined and published the notice for a competitive public tender and led the competitive dialogue which requested the bidders to make one proposal for several provisions (one lot for several provisions): Design, Financing, and Building; Technical operating; and Commercialisation of electronic communication services on behalf of the Auvergne Region.

A Selection Committee set up by the Auvergne Regional Council evaluated and selected the proposals according to the criteria mentioned in the tender and through several rounds of dialogue.

Digital Region, South Yorkshire, UK

The network is fully publicly owned. The network operating company, Digital Region Limited, is run as a not-for-profit organisation, with the board consisting of the regional development agency (Yorkshire Forward) and members of each of four city councils. The funding model (100% public ownership of the network) was chosen partly due to a view that there was a lack of other viable options, given the lack of market interest in the region.

The project is purely publicly funded and so 100% owned by the local authorities. However, the project also includes a revenue sharing agreement with the company which built and now manages and operates the project (Thales). It should be noted that Thales does not hold any equity in Digital Region Limited.

The public procurement was led by local authorities, and went through the normal processes of securing State aid clearance. A large amount of information was required during a long iterative process – however, this did help to focus on the project aims.

The tender was won by a consortium led by Thales (and including Kingston Communications and Alcatel–Lucent), whose skills and experience were considered the best fit for the project's requirements.

Originally a management team sat underneath the board ,to oversee contact with the network operator, Thales, who in turn managed any sub-contractors. Now Digital Region and Thales form a joint team at management level. This collaborative approach has speeded processes up by removing a layer of bureaucracy.

E.4 Joint venture model (and examples of partnering)

Lombardia, Italy

The structure of the investment has not yet been defined; but based on the currently available public documents, Lombardia region will act as an enabler, mediator and facilitator of investor interests, with a neutral role in intermediation and management.

The project foresees the creation of a holding which manages a number of local SPVs; the mechanisms for participation illustrated in the figure below vary according to how partners decide to participate in the equity (i.e. swapping cash, assets, infrastructure, and/or equipment for equity):

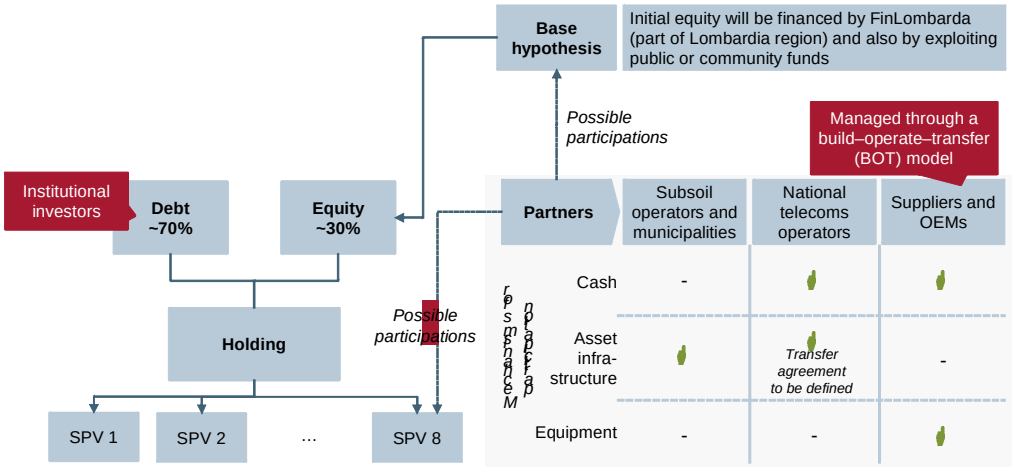

Figure E.1: Ownership and financing structure of Progetto Lombardia [Source: Analysys Mason based on public data]

Institutional investors include all suitable lenders, such as (investment) banks and (pension) funds. Subsoil operators are all organisations which have underground networks for their business (e.g. the tube company, the gas company, the sewer company (if not owned by the municipality)).

The SPVs will have a remit which is primarily defined by geographical area. Every SPV will have ownership of planning, realisation, wholesale commercialisation, provisioning and maintenance activities: this means that it will own all processes related to planning, construction, provision and maintenance of the dark fibre infrastructure (i.e. excluding civil infrastructure).

Total estimated investment is EUR1.0–1.4 billion, with an estimated realisation time of 5 to 7 years.

The philosophy of Progetto Lombardia aligns with the terms of a Memorandum of Understanding (MoU), signed between the Italian government and main Italian telecoms operators. The main principles of the MoU relating to the management and ownership model are:

– use of the public–private partnership (PPP) model to realise the passive infrastructure needed to deploy the next-generation network (NGN)

– the sharing of planning and financing activities for the realisation of passive infrastructure between the central government, telecoms operators, local public authorities (especially Regions) and public and private financial institutions

– the definition and management of local initiatives at the operating level are delegated to Regions, as already happened with Lombardia region for Progetto Lombardia.

Regarding service management, Progetto Lombardia will have an independent infrastructure manager which provides access to dark fibre to operators on an open-access/neutral-net basis. Final decisions and amendments to this general framework are subject to two main issues:

– the role and involvement of the incumbent, Telecom Italia in these projects (which in turn could affect)
– the actual ownership structure of the new holding company.

The participation of Telecom Italia (TI) also affects the evolution of possible scenarios:

– *total replacement*: if TI participates in Progetto Lombardia, the existing copper network will be switched off (which is already planned for the Milan municipality by 2015) and all remaining users will be migrated to the fibre infrastructure

– *overlay*: if TI does not participate in Progetto Lombardia, the existing copper network is likely to continue in operation with only some of the remaining users being migrated to the fibre infrastructure.

Midtsoenderjylland, Denmark

The investment featured the deployment of a fibre ring connecting four local city halls.

Following the installation of the core ring, discussions were held with Syd Energi, which felt that if it could supply electricity to rural areas it could just as easily supply FTTH. A large storm in 1999 had destroyed a large portion of Denmark's overground electricity network, meaning that local electricity companies were slowly migrating much of their electricity network underground. This gave Syd Energi a good opportunity to install the fibre at the same time as it installed the new electricity cables. To operate this network it agreed to rent the backbone of its network from the municipalities, until such time as its own backbone network was ready.

The electricity company and local municipalities had a common interest and so set up a less formal agreement rather than a contract (as it included no details of financial recourse) which allowed the electricity company to use the publicly funded fibre backbone. Denmark has a strong tradition of co-operative companies, so the municipalities were used to working with the organisational structure of the electricity company. Overall this partnership led to the municipalities paying only 1% of the total network costs, with private investment funding the remaining 99%.

Piemonte, Italy

An arrangement was made between the Managing Authority and the incumbent to attract investment to the area. The incumbent committed to upgrading a large number of exchanges at a cost of around EUR50 million, with the region agreeing to provide an equivalent value of resources in kind through developing services: e-health, telemonitoring, etc.

A further partnering arrangement was created for the operation of the newly created Internet exchange, to ensure that management of the exchange is seen as neutral. It was felt to be important that telecoms companies were included, to ensure that companies felt the exchange was run in a way that considered their interests. The exchange is now self-funded through member fees and requires no additional public funding.

In order to maintain control of the consortium the public has the majority stake (51%), and tight governance arrangements are followed.

Digital Region, South Yorkshire, UK

As described in Section **Error! Reference source not found.** above, the network operating model for Digital Region represents a form of partnering arrangement.

The network operating company, Digital Region Limited, is run as a not-for-profit organisation, with the board consisting of the regional development agency (Yorkshire Forward) and members of each of four city councils. The project also includes a revenue sharing agreement with Thales (the company which built and now manages and operates the project).

Originally a management team sat underneath the board to oversee contact with the network operator, Thales who in turn managed any sub-contractors. Now Digital Region and Thales form a joint team at management level. This collaborative approach has speeded processes up by removing a layer of bureaucracy.

E.5 Public DBO model

Midtsoenderjylland, Denmark

In 2003, an opportunity arose when four municipalities (including Vejen) decided to collect their ICT together into a centralised hub. To do this required a fibre connection between the four city halls, but the incumbent quoted a very high price to provide this and the municipalities decided to create the network themselves. A standalone business case was developed to link up the ICT of the four municipalities.

The tender for installing the network was offered to seven different companies, with the final offer being judged on both best economic and technical value. It was specified that the tender was for 48 fibres, but few other details were specified, to try and allow for creativity.

Several of the final bids were similar to the winning bid, with one having the same overall price. This bid, however, involved the electricity company owning the fibre and renting it back to the municipality, and was rejected as the municipalities wanted to own the whole ring (to ensure security of price and allow for more flexibility in the future). This turned out to be useful as it allowed additional municipalities to join the project later in 2006, during preparations for reorganisation of the Danish municipalities and regions in 2007.

The municipality now owns and operates the ring – with a repair contract taken out with an external company. Spare fibres are rented out to and operated by external companies, but the fibre used by the public network is seen as part of the cities' ICT networks and so is looked after by the cities' ICT administrators, to ensure they have control over how it is used. The general access network is owned and operated by the electricity co-operative.

The agreement to rent the dark fibres had to be priced at the accepted market level as it was against Danish law (and EU State aid rules) to disturb the market by subsidising FTTH, or to give preference to one company over another. However, given the extra competition created by this project the incumbent's fibre prices dropped to approximately one third of their previous level. In addition, external companies rented shared space within the ducts (which they used to add additional fibres), and they are paying for that access over a ten-year period.

Piemonte, Italy

The Piemonte project included a range of broadband investments, which were primarily publicly funded:

– A new regional Internet exchange, built with public funds. Operations are undertaken by a public/private consortium (with the public owning 51% to maintain control)

– A regional backbone with cloud computing infrastructure at regional nodes, built with public funds. Public traffic is operated by CSI (the organisation that operates Piemonte's public administrative ICT systems); private traffic is operated by the exchange consortium

– 700km of dark fibre primarily to commercial premises (e.g. industrial areas and offices) but also locations of public interest, built with public funds. Access to the dark fibre is managed by a third-party wholesaler, selected through public procurement

– A public-sector-only wireless network, built with public funds. The initial constraint on public-sector-only traffic was due to licensing constraints, but this inspired parallel private investment at a later date

– Public investment in new services (e.g. e-health, tele-monitoring, tele-control), in return for which the incumbent upgraded a number of exchanges in the area to DSL.

Most of the above investment was entirely publicly funded. This was done initially due to a low level of interest in the area among private telcos. This can be seen by comparing the economic value in different areas of Piemonte: for example, Turin accounts for around 90% of the region's economy but only 50% of the population, making it a far more attractive prospect for private companies than the more rural areas. This is reflected in the fact that the Turin exchange currently carries 20Gbit/s of traffic: ten times the average traffic on a regional node of the Piemonte backbone.

However, after a few years the private sector started becoming more involved in the project, though there was still a bias towards the more urban areas. It was felt important by the Managing Authority to make sure the project worked with the market rather than against it.

Overall the public sector funded 60–70% of the overall infrastructure cost, as the incumbent joined the project later on by making a commitment to upgrade a large number of exchanges at a cost of around EUR18 million. This was done in return for the region agreeing to provide an equivalent value of resources in kind by developing services such as e-health, telemonitoring, etc.

The procurements were structured into a series of lots, with the provinces split into roughly balanced values in terms of the potential commercial return. There were two main calls for proposals: one focused on the fibre network and equipment for the backbone linking cities (with an estimated payback period of 15–20 years); the second call focused on laying around 700km of dark fibre, a combination of new fibre (using existing ducts) and existing fibre (15–20%, which came from the incumbent's underused fibre, with ownership transferred to the Piemonte region or CSI). The incumbent was awarded more points for using more existing fibre and won several of the lots.

As the project was initially fully publicly funded, tenders were run using public procurement procedures – and because CSI itself is public owned it was also subject to public procedures.

RAIN project, Lithuania

Across most of Lithuania there is sufficient last-mile infrastructure for broadband, but the necessary core/backhaul network infrastructure and capacity are missing. The investment need is large and it is felt it would be carried out inefficiently if split among providers. It is envisaged that the project will connect public services to rural broadband network hubs and allow private users to connect in rural areas, thus helping to complete the national broadband strategy.

Three management models were considered for the infrastructure:

1 A collection of up to ten operators, one from each region, which provides wholesale services
2 The creation of a public management company which provides wholesale services, where the introduction of new services and infrastructure maintenance is outsourced
3 A private company, which manages and uses the network to provide wholesale services.

Two main problems were identified: the monopoly situation created under the last two models and the difficulty of ensuring that only wholesale services were offered under the first and third models (both of which may increase prices for users). Within Lithuania, the legal basis exists to control the monopoly situation (and would be especially easy under model 2); however, it is very difficult to prevent any private enterprises from providing services to the bulk, individual and vertical service markets at the same time. It was therefore decided to go with the second management model. To this end a non-profit organisation, controlled by the state, was formed to perform the exclusive functions of infrastructure management and control of the provision of services.

The state founded a non-profit public enterprise (Public Enterprise Plačiajuostis Internetas (PEPI)), to implement the project and manage the new infrastructure. All the assets and infrastructure belong to the state. Technology-neutral infrastructure is provided for institutions and end-user service providers to use (open access).

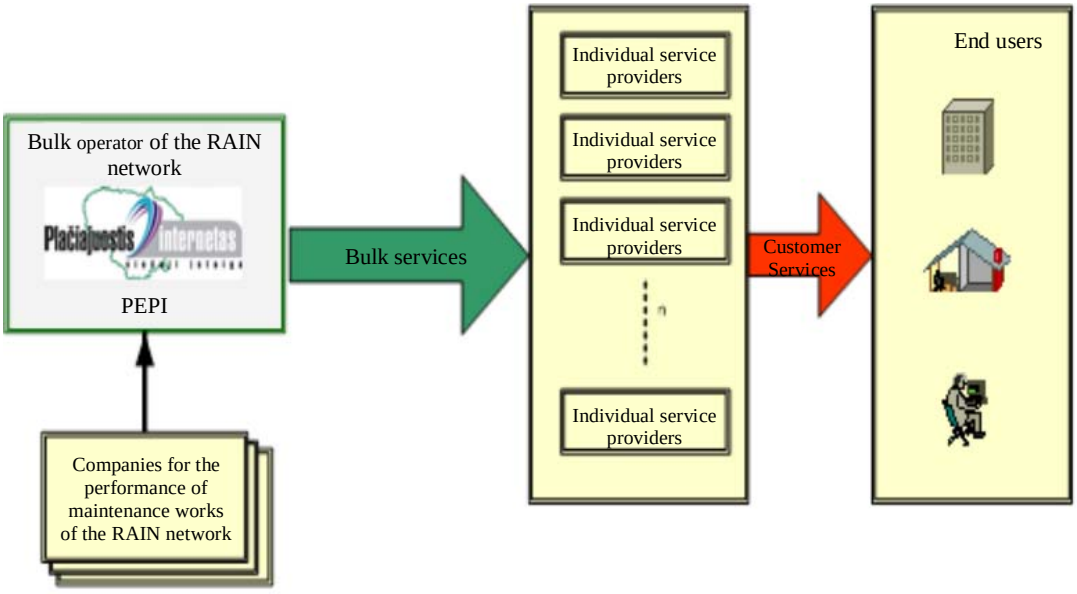

Figure E.2: Service provision diagram [Source: RAIN Project]

In order to avoid market distortions, PEPI controls the network but does not provide services to individual users. It is intended that the infrastructure will encourage providers of broadband services to invest in connecting users in rural territories.

It is important that PEPI is non-profit as it means service charges are based only on costs necessary to maintain the RAIN network. The chosen management model aims to maximise total investment by providers in order to provide the opportunity for users to choose among services, providers and technologies.

Procurement tenders of fibre-optic lines were structured geographically, with one tender for each two administrative regions (ten in all in Lithuania). In total there were five tenders for fibre-optic lines. Tenders for network equipment were structured by equipment type: data transmission equipment, WDM equipment, network management systems and so on.

The tenders were evaluated differently: some by smallest price, others by economical usefulness, depending on the complexity of the tender. The prices that were proposed during the tender were very close to the planned prices in the budget of the project.

STOKAB, Sweden

The city paid the initial set-up fees (EUR5000), but after this there was no public investment in the company. Following its creation, STOKAB applied to a bank for a commercial loan and used this to start the network. The profits from STOKAB's business are reinvested to expand the fibre network, and if STOKAB stops investing the money it is legally required to reduce the price it charges customers for fibre.

The municipality of Stockholm chose this model as it was felt that all other methods would have required a telecoms partner, which may have created conflicts of interest which would stifle competition.

STOKAB runs the backbone and access network (essentially a fibre meshed network) only, and provides no services to end users. Once STOKAB's customers have rented the dark fibre they can use it for any purpose. In addition, all of STOKAB's investment is made in response to demand from customers; so STOKAB knows it will not build dark fibre that will be unused.

Initially STOKAB's main customers were large businesses (for example, banks that required their own secure networks), however it quickly expanded into supplying broadband-intensive businesses, before moving onto SMEs and finally apartment blocks and housing.

To save money there was some re-use of ducts. Several agreements were made: first with a cable company (owned by the city), then with Stockholm's private subway company, and with the local electricity companies. However, it was felt that this re-use was limited due to the different type of network design and infrastructure required for fibre compared to other utility networks.

It was highlighted that STOKAB received no special help from the municipality, and had to pay the same price for digging up the streets as other operators. In addition, because of the hands-off approach taken by the municipality no State aid or competition regulations needed to be considered.

STOKAB has many different types of customer, covering all sizes and businesses. The main operators that work with STOKAB do so under a framework developed over time between them and STOKAB. This framework helps ensure that STOKAB builds in the areas they most need and helps maximise utilisation of the STOKAB network. The smaller customers send STOKAB a request and STOKAB gives them a quote. A key point is that no matter how small an organisation is, it always receives the same contractual terms and price as the larger customers.

STOKAB uses fibre patch panels as the handover points to customers. STOKAB will supply a patch cable into a space owned by the customer. It was explained that STOKAB does not build vertical networks within multi-dwelling buildings. To date, both FTTH and fibre-to-the-building (FTTB) style access have been installed, but the current trend is moving towards FTTH, driven by the city's largest housing company.

In Sweden it is felt that public companies such as STOKAB should aim to do as little as possible that could have been undertaken by the private market. This meant that STOKAB tried to outsource / procure as much as possible, and had to follow the usual procurement rules. The procurement was split into two parts: one tender for the digging and the other for the production of fibre to a particular technical specification.

All of STOKAB's procurement is undertaken under a 'procurement framework' that was created (for both deployment and management of the network). A number of subcontractors are awarded preferred status and then these subcontractors are allowed to bid for each tender. However, it was noted that when STOKAB started, fibre was such a new technology that in certain cases STOKAB had to educate the contractors about how to install it properly.

A building co-ordination procedure exists in Stockholm to try and ensure that building works are synchronised. This allows STOKAB to install fibres at the same time as other companies are digging trenches throughout the city. The city set up this procedure because it thought it would be both cheaper and less disruptive for the city if all digging works were condensed into as short a period as possible.

Alto Adige, Italy

The Alto Adige fibre broadband project is to be fully funded by the public administration of Bolzano, which is the owner and operator of the infrastructure. The administration will then then rent part of its capacity to the telecoms operators to provide broadband connections to the local premises and businesses.

The Italian regulator is not directly involved in this project. The only entity which regulates this fibre roll-out project is the Bolzano local Council.

The Bolzano local Council carried out all necessary technical and economic valuations and also took care of the network design and the procurement phase.

In particular, although not directly involved in the execution of civil works, the local municipalities have a role in gathering information and co-ordinating with all other entities that are present in the area to improve the scheduling of future works.

All suppliers involved in this project have been shortlisted and selected through a combination of public tenders (in particular when the amount of work and therefore the investment is significant) and through selection from a sample of pre-qualified suppliers which have previously worked for the local Council on other projects.

The critical success factor which enabled both the previous and the current project to be completed on time and meet all of their targets is the centralisation of the responsibilities, management and co-ordination of the network within a single entity (i.e. the local Council). In fact, this was believed to have been paramount in avoiding duplication of activities (whether paper based or actual civil works).

Annex F Demand activities from example projects

This annex includes extracts from interviews with example project stakeholders, which describe the demand activities from example projects.

OnsNet, Nuenen, Netherlands

Before the project broadband demand was estimated to be in the region of 30%. In order to create demand the project undertook an 'education programme', showing people that fibre is useful, focusing on how it enhances quality of life (especially for the elderly), rather than emphasising the technology. The range of services that FTTH brings was also emphasised, with a key focus on communication, such as video calling relatives, remote attendance at church services and e-health style facilities. On completion of the project around 50% of the people were thought to have bought new wireless routers or new computers.

On creation of the co-operative 85% of the population signed up with a six-week period of demand aggregation, showing that there was real demand once the project was started.

Rural Development Programme, Sweden

When the project was started the Board of Agriculture had almost no picture of the demand and worried that it would be unable to find sufficient demand from local communities to get the grant money working efficiently. However, on initiation of the project it was found that demand from local communities was actually much higher than anticipated: applications became so strong that the initial tranche of funding was allocated within only a year.

Following this initial round of funding, the government has given additional money on a temporary basis, and EUR15 million has been redistributed by the county administrative boards towards broadband projects. The counties have also applied to the government for more funding to try to meet the significant unfulfilled demand.

One of the key lessons learned from the project was the importance (and difficulty) of establishing a clear picture of the actual demand at the outset of a project. Having a clear picture would have allowed a redistribution of funding from other government sources to occur much earlier in the process.

DORSAL, France

Demand was considered as part of the initial study undertaken prior to the project, which sought to determine the needs of individuals and enterprises in the Limousin region in terms of broadband, and how these could be satisfied.

The initial speed requirements estimated in 2004, and for which the network was designed, were a minimum of 10Mbit/s symmetrical for enterprises and a minimum of 1Mbit/s asymmetrical for end users. It is felt that these speeds are no longer sufficient, due to rapid developments in technology. However, the technology used to build the core network is future-proofed as it can cater for higher speeds and allows for upgrades.

Piemonte, Italy

At the beginning there was a lack of visible demand, with broadband penetration at around 25%. Now, however, there is 60% Internet utilisation with only 2% of the population using narrowband. The fact that 40% of the population is not using the Internet is attributed to the large elderly population. This has led to the development of 'black-box solutions', especially in areas such as e-health, so that end users do not need to interact with PCs.

In terms of the new Internet exchange, from the start of the project the exchange was open to everyone, not just telcos, and currently it is used by a range of vendors, telecoms operators and public organisations. A survey is run every year to monitor current demand at the exchange.

Furthermore, the public consortium invested in new services to create demand for Internet connectivity (such as e-health, tele-monitoring and tele-control). In return for this investment, the incumbent committed to invest in the upgrade of a large number of local exchanges.

Midtsoenderjylland, Denmark

There are three examples on the project of how demand had emerged following the fibre network installation:

– Farms which need good ICT infrastructure to store/transfer information on cattle IDs etc. now use the fibre network to back up this information securely.

– A car wash company that previously had slow ADSL now uses its fast fibre connection to allow the owner to manage the site remotely using video cameras.

– An architect in a rural area is now able to transmit his digital drawings quickly and efficiently to central offices/clients, and so can sustain his rural practice.

North Karelia, Finland

It was felt that having knowledge of the demand in a region was a key factor in any telecoms operator decisions, and therefore important to understand before a project is started.

For the eRegio project, the actual demand was not measured, but instead calculated using the estimate that 50% of people would be interested in signing up initially and more would join the project at a later date. With this estimate a demand figure could be calculated just using the Regional Council's population data.

In the new project surveys are run to check the demand before construction starts in each area. However, as only estimates of price can be used to gauge demand, the actual demand realised may vary if the actual price is different from the estimate. The real demand is only seen once the project is underway, with the 'excavators on the ground' effect that was highlighted earlier.

South Yorkshire, UK

The project had a reasonable understanding of demand due to the amount of research undertaken before the project began. This was largely due to the State aid process, which required a large amount of information to be delivered during a long iterative process. It was felt that this process had the added bonus of helping to focus the aims of the project.

The Digital Region project had planned many demand creation projects; however, following the economic downturn and a shift in UK governmental policy, there was a reduction in the budgets of Regional Development Agencies (RDAs) and they were later abolished.

This has meant that many demand-side programmes did not come to fruition as originally planned. The newly created Local Economic Partnerships (LEPs) (which replaced the RDAs) have started looking at demand programmes themselves, but it is still too early for any demand projects to have re-emerged.

RAIN project, Lithuania

In order to determine the need for broadband in Lithuania's rural areas, a survey was carried out, allowing the municipalities to help estimate the need in all of the country's rural areas. The results of the survey show that there are more than 11 000 organisations in the country's rural areas, which would want to connect to a broadband network. A significant proportion of them (about 19%) were various businesses, including large farms, rural tourism and other types of business. About 15% of the identified organisations in rural areas were educational establishments. A large part, about 13%, were healthcare establishments and another 11% of the identified organisations in rural areas were libraries.

About 1200 libraries in rural areas are participating in the Libraries for Advancement project. The project aims to: make it possible for every resident of Lithuania to use computers and the Internet free of charge in all public libraries; and encourage residents to make active use of this opportunity. The Ministry of Culture has provided a list of libraries where a strong need for broadband communications has been identified.

In order to accurately estimate the demand for, and ensure the provision of, broadband in rural areas, the operators provided a list of infrastructure that could be used to provide services to end users. The operators also agreed to allow third parties (other operators) to place equipment necessary for the provision of the services in objects that will be connected to the infrastructure of the RAIN network.

Auvergne, France

The identification of the lines which were unable to receive broadband Internet was technical, based on data purchased from the incumbent operator. The technical data was compared with the complaints from end users and public officials.

A website was also created to present the project and to inform the inhabitants on deployment progress, commercial opening dates, and the available Internet providers.

STOKAB, Sweden

The majority of demand was driven by the operators. Outside of this, a lot of demand was driven by outsourced ICT networks for business. In addition, the city holds activities to teach IT skills to people who are not used to using the Internet.

STOKAB only builds its networks in areas to which its customers wish to expand, and so a small proportion of the demand risk is shifted to the customers.

Lombardia, Italy

Regione Lombardia plans to stimulate demand for superfast broadband by developing targeted services by demand type (Public Administration (PA), businesses, private users), by creating initiatives to promote digital service use and by making a larger number of PA documents available online.

Investments will also be made to digitalise and centralise services on one regional system. Finally, ICT-producing sectors will be strengthened and collaboration between businesses aimed to improve ICT education will be enhanced.

Alto Adige, Italy

The fibre roll-out has been sized to prioritise the provision of services to remote areas which are not covered by fibre. In particular, the network has been designed to take account of businesses seeking fibre network connectivity first (including touristic areas).