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Successful municipal and regional projects in overcoming gaps in broadband provision.

A RESEARCH ON BEHALF OF THE
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Content

1 Abstract

In the past 15 years, the Internet has developed rapidly both technically and in content. Whereas at the beginning only few offers were available, mainly consisting of text documents, there has been an increase in new multimedia content over the years. The technical development, known today as web 2.0, has contributed to the fundamental change not only in the technical conditions and standards but also in the way services and content are used today.

The relevance of a fast internet connection and the disadvantages of having poor access are basically indisputable. Not only in the telecommunications sector broadband is a central growth factor. Economic growth can be effected by improved communication possibilities.[1] Increased productivity and new areas of business are connected to that and can have a positive effect on employment in the long run.[2]

In questionnaires firms measure the same importance to broadband connection as to convenient traffic accessibility or availability of qualified personnel.[3] A decisive factor for the location of households and small businesses is the availability of broadband internet and the access to information and the communication possibilities that come with it. The unavailability of broadband can lead to structural problems in the affected regions and can in the worst case lead to moving away of firms and young people.

In the past years the telecommunication companies have invested huge amounts in the modernization and expansion of Germany's broadband infrastructure. Even in the coming years, extensive investments are planned in the development of the network.

1 See: OECD – The role of communication infrastructure investment in economic recovery (2009) p. 5

2 See: Katz et al (2009): Die Wirkung des Breitbandausbaus auf Arbeitsplätze und die deutsche Volkswirtschaft

3 See: Breitbandzugang als Standortfaktor für Unternehmen im ländlichen Raum Baden-Württembergs 2009

Today 22 million of the 24 million broadband connections are DSL connections integrated in the classic telephone connection.[4] A pioneer in the expansion is "Deutsche Telekom AG" which as a privatized company plays a huge role in the improvement of provision. With that Deutsche Telekom AG plays an important role in expansion of infrastructure especially in rural municipalities and regions in spite of the steep competition which is carried out in price. The economic pressure has led to expansion being carried out only when profitable even for the former state owned firm.

Competition in the telecommunication sector has led to a diversification of technological approaches. Even if DSL is the widest used connection technology, alternative technologies are constantly taking ground in market participation.[5] First firms have started laying glass fiber cables in areas with high population density with which they directly connect their customers. These connections, known as „fiber to the home" (FTTH) are considered to be a secure investment because they provide almost unlimited bandwidth. Even cable network companies are beginning to upgrade their existing network in many towns and municipalities to facilitate use of telephone and internet in addition to digital television reception. Thanks to this investment, 1.9 million users are online using the TV cable connection. With that, broadband using television cable has become the second most important connection technology.

In recent times, radio technology has become increasingly important in establishing broadband internet connections. The technological development in the past years makes it possible to use radio linked technology to provide customers with a high data speed. Internet connections are now being offered more and more using radio networks which are based on WLAN or WiMAX. Mobile communication systems have won in significance as a medium of transfer for large data packages since the auction of UMTS frequencies. With the further development of UMTS, HSPA, fast internet connections can be used on the way.

The research „Successful regional projects in overcoming gaps in broadband provision" should show how overcoming broadband provision gaps can be achieved at local and regional level. This abstract gives an overview on the results of this research.

4 See: EU Commission COCOM09-29, p. 10

5 See:EU (2009): Broadband access in the EU (COCOM09-29)

2 Method of Research

2.1 Outline of the problem

The increasing diversity of connection technology and the increasing bandwidth on one hand is counteracted by regions in which modernization of existing, or establishment of new infrastructure is not possible or only possible at very high costs due to topographical issues or low customer potential. In most of the areas that are currently under-served, the distance between the multiplier and customer are so large that it is not possible, with the existing copper cables, to provide a broadband internet connection based on prevalent DSL-technology.
At first glance, the problem of poor provision of broadband internet seems easy to solve: In 2009 the overall provision for households in Germany with the minimum requirement of 1Mbit/s in downstream was 96.7%. This figure however does not show that there is a provision problem for small municipalities in rural areas and that some regions are completely unprovided for, these are the so called white spots.

These regional disparities are a result of a low number of potential customers in rural areas. Due to the sparse settlement the investment costs are comparatively higher than in urban areas and the profitability is achieved a lot later.

2.2 Aims

The German federal government wants to give the expansion of broadband infrastructure more impulses. At the beginning of 2009, the federal government drafted ambitious goals in the framework of the broadband strategy[6]:

• Gaps in broadband provision should be closed and there should be an efficient, blanket coverage of broadband connection by the end of 2010
• By 2014, 75% of households should have connections with speeds of at least 50Mbit/s with the target of having blanket coverage of such connections.

The package of measures in the broadband strategy envisions promoting the use of synergies in the expansion of infrastructure, guaranteeing a supportive frequency policy, a growth and innova-

6 See: Broadband Strategy of the Federal Governnnment (Breitbandstrategie der Bundesregierung, 2009) p. 5

tion oriented regulation and providing necessary funding through different support programs. The federal government plays a big role in supporting the municipal councils.

The research carried out in the autumn of 2009 aimed to show how the problem of broadband provision gaps can be solved at local and regional level. The core of the research was to show good examples, which inspire decision makers at local and municipal councils to embark on expansion in their areas of jurisdiction. The initial conditions are different, in terms of topography, demography, political and economical situation, existing infrastructure and commitment of local participants - these are important but very individual and partly dynamic factors that largely determine the success of an expansion project.

2.3 Data collection

The central part of the research are good examples which visualize the possibilities as well as the difficulties in expansion of infrastructure in different regions of Germany. The documentation of such projects differs greatly in quality and quantity. This is why a standardized questionnaire followed by targeted interviews were used to collect and analyze necessary information.

The questionnaire concentrated on collecting the main aspects of each project. These included the financial, size and time scope, the size of the provision gap, the approach used as well as the main participants and the person responsible for the project. In addition the persons responsible for all participating projects were requested to provide information material such as press releases, short descriptions, protocols and similar documents for evaluation.

In order to achieve a broad diversification of the research and with that a large number of projects that are potentially interesting for the research, the questionnaire was electronically distributed to more than 800 multipliers. In addition, responsible people from regional and countrywide broadband projects were contacted directly.

Based on the data collected with the questionnaire, detailed information on the content of the project and approach was collected through semi-standardized expert interviews with local participants as well as those involved in the projects and users.

While data was being collected, emphasis was laid on interviewing different people involved in the same project but playing differing roles. This procedure was to ensure an objective picture of the project approach. The goal of the interviews was to identify motives of action and questions set that were considered relevant to project procedure.

The research is aimed at collecting quality data. The most important aspect is to get information on the approach, about the motives behind the decisions of participants and to content design of the projects. This approach is maintained in the analysis of the data. From the qualitative data material, hypotheses were formulated, resulting conclusions drawn and recommendations for course of action made.

2.4 Subject of study

Large structural differences were made clear while analyzing the projects, the reason being the individual frameworks under which the projects are realized. This leads to a multitude of strategies and thesis of the players to solve the problem of under-provision.

Among the factors that determine the framework are mainly the topography of the region at hand (settlement structure, geology, natural barriers), the size and form of the provision gap (number of households unprovided for), the administrative situation (number of participants, jurisdiction) and the resources available (present infrastructure, resources). Each of the investigated projects has an individual character in terms of framework.

By sketching the frameworks, the complexity of each project is made clear. Interdisciplinary diversity is characteristic of all cases which intertwine technological and business administrative aspects as well as the topographical data.

Many projects are in an ongoing development process to meet the increasing need for broadband as well as accommodate the future demographic development. A short implementation time for projects is basically desirable if it leads to solving the problem quickly. Still, long term projects that target construction of a high potential broadband infrastructure are most welcome.

2.5 Sample of best practice examples

Many considerations resulted in selection and characterization as an example of best-practice. The central aspect was fulfilment of defined success indicators which make a project a model relevant to other regions and municipalities and at least partly transferable. In the research at hand, success of an expansion of communication infrastructure project will be measured against the following 3 indicators:

1. Adherence to national goals.
The goals of the examined projects has to be conform with the broadband strategy of Germany's federal government from the year 2009, which means infrastructure expansion with minimum of 1Mbit/s short term and planning or building a future infrastructure with a minimum of 50Mbit/s.

2. Transferability of procedure
The realization of the project or parts of it show a pioneer approach that could offer future projects important impulses.

3. Foresighted solutions
The infrastructure has been implemented sustainably from a financial and technological point of view. This involves the bandwidth and the scalability and the extensibility of the technical infrastructure as well as a model of financing that is competitive, works profitably and guarantees a network expansion from a financial point of view.

In a further step, the chosen 30 best practice examples were categorized according to the main areas of activity which were depicted when interviewing the project participants. These areas of

activity are going to be titled „economic“, „technological“, „administrative“ and „other“ in this research. The classification in a category means that the project is a role model in the specified area of activity and procedure seems suitable for emulation by other regions and municipalities.

To the category „economical“ belong the best practice examples which are role models in terms of their economical framework and strategies of financing. To the category „administrative“ belong examples that demonstrate good project organization at different levels and the roles of municipal councils as well as other participants. Examples of best practice in the category „technical“ exhibit good and especially sustainable solutions in implementing expansion. The category „others“ contains examples that are not directly imitable for example because of the specific starting situation. Still, these projects demonstrate in some areas interesting approaches for example the technological or financial implementation that offer impulses for other regions in their search for solutions.

All federal states (with the exception of city states) were, where possible, equally taken into consideration in choosing.

3 Best Practice Examples

The problem of under-provision is present in the different regions of Germany: the lowlands of northern Germany are affected just as the hilly landscape of the Harz foothills are or the regions with prime location in the south of Baden-Wuerttemberg.

The examples that are examined in this research are located all over the republic. Because of this, it is possible to show a variety of initial conditions which could act as stimulus for own solutions. This is the case for topographical conditions as well for specific political and administrative conditions which could differ from one federal state to another. Not only the initial conditions are interesting, but also the different solutions that are used in similar conditions.

The examples in this study are not the conventional best-practice examples; they do not depict the one and only valid solution for the expansion of infrastructure in a given situation. They are more of examples that have found feasible solutions in given individual situations to close provision gaps in their respective regions.
In a large number of examples, the success is based on initiatives of citizens or local firms. It was often a cooperation at public and private level that created the solutions for broadband expansion.

Using present infrastructure is to be considered sustainable and cost reducing. Many projects have made use of this option. Interesting and successful results were also brought up by the use of alternative technology, mostly radio technology or a mix of technologies.

3.1 Examples from an economic perspective

To the category „economic“ belong the best practice examples that are role models in terms of their economical framework and financial strategy.

Municipality of Beverungen (NRW)

The driving force of this expansion project was a citizens' initiative. Through the commitment and competence of citizens involved, different solutions were looked into and a necessity analysis was done. With their support it was possible in spite of topographical hindrances to build a wireless network which is run by a private internet service provider.

County of Birkenfeld (RP)

This example demonstrates that available resources often help find a solution. Existing networks, previously used primarily for commercial purposes and existing empty conduit capacity help to provide services cost effectively. Pooling demand makes a calculation of profitability possible. Confidence of the municipal council and citizens in this case provided a credible solution.

Municipality of Blankenheim, district of Alendorf, Ripsdorf and Waldorf (NRW)

To provide the component localities of the municipality of Blankenheim with broadband internet connection, a citizens' initiative was decisive for the success. The costs of infrastructure provision not covered by municipal financing could be avoided only through own effort. See below for a detailed description of this example.

City of Cuxhaven (NI)

Founding a citizens' initiative and the commitment of many helpers was what placed emphasis on the necessity of expansion in Cuxhaven. On the basis of the help of targeted public awareness it was possible to illustrate the necessity and made it possible for service providers to act fast. The expansion done by Deutsche Telekom AG was the initial spark that led to infrastructure provision with the most modern broadband technology. After the establishment of blanket coverage of DSL infrastructure there was a modernization of TV cable network. In addition there was a FTTH network built in Cuxhaven.

Municipality of Mulda (SN)

The example shows that it is possible, in spite of reservations towards a technology, to regain confidence through direct dialogue. A radio based network was used to provide a region that has difficult geographic conditions with broadband internet. The scalability of the technology enables the network to be run profitably with less than 50 users and can quickly be expanded at any time.

Municipality of Oerel, districts of Oerel und Barchel (NI)

The municipality decided on a public-private cooperation with a third party provider to provide blanket coverage broadband internet, after the local service provider declined service provision. The participation of the municipal council in the company „Oerel, unser Ortsnetz co ltd" secures its say in the future. The transparent approach of the mayor and trading off the alternatives with the citizens increased confidence in the solution finally agreed upon. It was thus not difficult to involve inhabitants in the realization so as to reduce costs. The FTTH technology implemented is future oriented and guarantees even in a number of years a high performance connection.

Municipality of Seddiner See, district Neuseddin (BB)

This example makes it clear that the choice of technical components plays a vital role in the reliability of a wireless solution. In spite of the bankruptcy of a service provider, a new network provider managed to regain the confidence of the population in the application of wireless technology.

Municipality of Sternenfels (BW)

The example in Sternenfels shows the necessity of looking for alternative partners even if they are not in the industry when established service providers refuse to cooperate. Only getting in touch with the local administrative union Bodensee-Wasserversorgung and the Sparkassen-IT made it possible to reach not only the company Hartchrom-Schoch but also the population and the companies in the municipality. See below for a detailed description of this example.

Municipality of Wenden(NRW)

With the implementation of a reliable WLAN technology it was possible to make provision for an entire industrial area which would have remained underserviced. Wireless technology proves to be efficient enough to provide companies in an industrial areas with necessary services for example support of VoIP systems. The decisive factor for this was, apart from the technical solution, the joint financing of the project. The commune provided loans that made the development possible and that made the industrial property attractive for rent or acquisition.

Two best practices will be presented in more detail in the following section.

Municipality Blankenheim, districts Alendorf, Ripsdorf and Waldorf

State

North Rhine-Westphalia

Area

50 km²

Population

1,120

Population density

22 inhabitants per km²

Through the effort of about 60 citizens in the municipality of Blankenheim, a 4km distance was dug up to lay glass fibre cable. This made provision of new connections possible by the use of an existing backbone within a very short time.

1. Initial situation

Blankenheim is located about 27 km south-west of the district town Euskirchen, on the west boarder of the Ahrgebirge/Eifel. Blankenheim is divided in 17 boroughs. Due to many streets and isolated farmsteads, the area is very scattered.

The area, two thirds of which is forested, has an average difference of 100m with the highest altitude at 500m above sea level. 3 of the 17 boroughs, Alendorf, Waldorf and Ripsdorf, are especially under-serviced.
The existing copper cable does not allow more than 384 kbit/s downstream, because of the large distances to the main multipliers. Coaxial and/or TV cable network is not available in those 3 districts. Data connection via radio service is not possible in most areas due to inadequate network coverage.

2. Scope and Technology

Description of applied technology
To install broadband in the affected districts Alendorf, Waldorf and Ripsdorf it was necessary to install a faster connection to the multiplier of Deutsche Telekom in Ahrmühle. The multiplier was previously fed by copper cable and had to be equipped with up to date circuitry. According to Deutsche Telekom there is a glass fibre backbone available 3,9 km off Ahrmühle close to the town Esch on the route Cologne – Trier.

To connect the multiplier to the backbone it is necessary to install a glass fibre cable. In three months' time about 60 citizens of the affected districts dug a 60cm deep pipe route in which they embedded ductwork which was provided by Deutsche Telekom. The district Waldorf is located on this route and could get connected during the initial work.

The glass fibre cable got connected to the multiplier in Ahrmühle. The districts Ripsdorf and Alendorf, both are about 1,5km off Ahrmühle and over this distance the existing copper cables can provide a high speed connection with 16Mbits/s maximum. In addition to the excavations, the citizens had to provide related road construction and landscaping.

Declaration of speed, tariff arrangements and pricing:
* up to 2,048 kbit/s downstream and up to 192 kbit/s upstream, €29,95 a month, 12 month term of contract
* up to 6,016 kbit/s downstream and up to 576 kbit/s upstream, €39,95 a month, 24 month term of contract
* up to 16,000kbit/s downstream and up to 1,024 kbit/s upstream, €49,95 a month, 24 term of contract

All packages offered included an internet flat rate. There is a one-time connection fee of €59,95. The provider offers installation services for €69,98. The customer receives a splitter free of charge in the mail. It is possible to order a WLAN router for an additional monthly fee. Voice-over-IP is possible in all options. Triple-Play-service is available for an additional monthly fee.

3. Project description

End of 2006 the district mayor of Ripsdorf in the municipality Blankenheim was confronted with the problem of missing broadband internet for the first time. Particularly younger citizens of Ripsdorf addressed this several times. Due to these inquiries the district mayor contacted the local telephone provider via mail. When he did not receive a reply, he initiated a petition to put emphasis on his request. About 300 citizens of Ripsdorf signed the petition.

In early 2007 the municipality again turned to the provider with this petition and another letter. A couple of month later a citizen of neighbouring Waldorf presented an idea to the district mayor to connect the multiplier to the glass fibre backbone of Telekom near Esch, 3,9km off Ripsdorf.

This idea was presented to Deutsche Telekom and they were willing to negotiate. In early 2008 they presented an offer at the city hall. The municipality was left with two options: 1. The provider develops the connection and the municipality will be presented with the bill or 2. Municipality and citizens will provide all necessary labour to install the pipes needed to connect the multiplier to the backbone.
The second option was chosen due to lacking funds and so municipality and citizens dug and installed the pipes themselves.

An open council of municipality and provider was held shortly after to inform all citizens of the three districts. A great majority approved of the plan, to install the pipes themselves to save funds. 60 citizens volunteered to take part in the construction works. Meanwhile engineers and technicians of the provider started to survey the area and lay down the placement of the pipes.

In late march the excavations began ontime. The municipality provided an excavator free of charge. The volunteers were assigned to different shifts during six day a week to excavate the 3,9km long and 60cm deep pipe route.

The provider had previously delivered the pipes and the lava sand needed. During the excavations a contact person of the provider was present and documented the forthcoming. The pipes were installed end of May 2009. A contractor of the provider connected the glass fibre cable. Finally the multiplier got rewired and upgraded.

An open council was held to thank the volunteers for their work and commitment and to report the completion of the installation.

The provider informed the audience about the possibilities that were given and offered by the new broadband-internet connection. The customers were connected in late August.

Afterwards the municipality received a large number of inquiries of other municipalities about their experiences.

4. Type and amount of financing

Due to the commitment of Blankenheim citizens the costs were reduced significantly. This enabled the provider to connect the households affected on a rational cost level. The municipality provided an excavator and wasn‘t burdened with any other costs.

Planning costs in EUR	0	**Amount of granted aids in EUR**	0
Cost for building up in EUR	not specified	**Name of funding programme**	-
Municipal contribution in EUR	0	**Amount of additional financing means in EUR**	0
Network open to the market	yes	**Refinancing of network (date)**	not specified

5. Conclusion

The commitment of many volunteering citizens was crucial to provide broadband internet to the districts of Blankenheim. Solely this effort could avoid the cost for the development, for which the municipality did not have funds.

Municipality of Sternenfels

State

Baden-Wuerttemberg

Area

17.32 km²

Population

2,800

Population density

162 inhabitants per km²

The inclusion of alternative project partners and utilisation of existing infrastructure of Bodensee-Wasserversorgung as well as community-owned empty conduits allowed the connection of, a so far under supplied, community.

1. Initial situation

Sternenfels is the northernmost municipality in the Enuresis in Baden-Wuerttemberg. It's located about 20km linear distance to Pforzheim in north-eastern direction and about 38km east of Karlsruhe. Just over a half of the municipal area is forested.

The municipality Sternenfels, consisting of the two districts Sternenfels and Diefenbach, which were covered insufficiently. Parts of Sternenfels were covered with DSL light while Diefenbach didn't have perspective to be covered. Both industrial areas weren't connected to broadband.

2. Scope and technology

Description of applied technology
Different technologies were used to extend broadband coverage in Sternenfels. Businesses received access via glass fibre cable. Households got covered via WLAN and licence-free Pre-WiMAX.

For the main connection to Sternenfels the glass fibre cable of Zweckverband Bodensee-Wasserversorgung was used. This cable was originally installed to supply a steering mechanism for a pumping station. Since several fibres of the cable remained unused it didn't require a great effort to realise a connection to an internet-backbone of Sparkassen-IT in Pforzheim.

Starting at the pumping station two glass fibre bundles were run, one in the direction of Sternenfels and the other towards Diefenbach. This was done in an open construction method on an unsurfaced route to avoid the necessity of tearing up pavement.

One of the glass fibre cables was placed in open construction to the outskirts of Sternenfels. From there it runs in pre-existing municipal pipes. In Sternenfels itself the glass fibre cable runs to the TeleGIS Innovation centre. There a server and all necessary technical equipment had been installed. To reach the industrial park in the north-west of the town the

cable has been installed again in municipal pipelines and then open construction. That way several businesses in the industrial park received access to FTTH.

The connection of the households in Sternenfels was managed by establishing a wireless connection. Starting at the TeleGIS building Wireless GmbH transmitted a focused signal to a radio station on the Schlossbergturm. From there a Pre-WiMAX-Network supplies households and businesses alike in Sternenfels.

Also starting at the TeleGIS-building another cable was installed to supply Diefenbach. On the way to Diefenbach a branch to the local industrial parks was installed too. This way the connection of the residing company Hartchrom-Schoch was warranted. In Diefenbach then a single radio/transmission tower was connected to the net from which Skytron provides WLAN to households and businesses alike.

Declaration of speed, tariff arrangements and pricing

Those businesses located in the industrial parks have access to FTTH with is provided by Sparkassen-IT Pforzheim. They offer two different speed- and service-options. Customers can choose between a tariff with balanced bandwidth of 10Mbit/s and the highest service-level for €1400 a month and another tariff with balanced bandwidth of 4Mbit/s and standard service-level for €289 a month. The service-level regulates contractual conditions such as scope of service, response time, promptness of handling as well as availability. Connection speed can be scaled up to 10Gbit/s upon customer request.

In Sternenfels Wireless GmbH offers a connection with 2Mbit/s downstream and 512kbit/s upstream for €29,90 a month. An additional €150 are charged upon configuration to cover the cost of the modem.

In Diefenbach Skytron supplies all residing businesses and households wireless with a balanced bandwidth between 1 and 20 Mbit/s for €19,99 a month. Customers receive a basic supply/connection for €19,99 a month. For higher speed connection each additional Mbit/s up- or downstream is charged with an additional €1,49 a month. A one-time connection/configuration fee of €149,99 is charged. Telephone service is included.

3. Project description

The original cause for this project was the fact, that Hartchrom-Schoch, a worldwide operating company, wanted to install itself in Diefenbach while providing 200 jobs. They declared a glass fibre connection a requirement. To pave the way, the municipality Sternenfels contacted several providers. None of them was willing to provide a glass fibre connection for Hartchrom-Schoch. So other solutions were sought after. This included contact to institutions which don‘t usually serve as providers like the Sparkassen-IT Pforzheim Calw and the Zweckverband Bodensee-Wasserversorgung.

Two fact were determined:
1. The Sparkassen-IT had plans to modernize their network in the area. This also meant to connect the Sparkasse in Ster-

nenfels via glass fibre cable.
2. The pumping station of the Zweckverband Bodensee-Wasserversorgung are equipped withglass fibre cables to navigate and control the station. This also applies to the pumping station which is located between Diefenbach and Sternenfels.

On this basis the municipality Sternenfels initiated a dialogue with Sparkassen-IT and Zweckverband Bodensee-Wasserversorgung. When the ‚Ministerium für Ernährung und ländlichen Raum' in Baden-Wuerttemberg had approved of the use of some fibres of the glass fibre strand of Bodensee-Wasserversorgung, project development began.

It seemed obvious that the municipality Sternenfels gave access to its own pipelines since the inner-city earthwork (tearing up and refinishing pavement) makes the biggest costs when installing cables. Thereby the costs for Sparkassen-IT (which would have had to do this to connect Sparkasse Sternenfels) were reduced so radically that the connection of the industrial parks as well as the points of presence were covered.

Sparkassen-IT took control of the project. They planned the network, coordinated and supervised the implementation and supplied the administration technology. All parties involved emphasized the good cooperation and un-bureaucratic approach. Small problems were solved quickly before they could interfere and severely disrupt progress.

4. Type and amount of financing

No costs arose to the municipality. The costs were covered by Sparkassen-IT due to the already planned expansion. Refinancing the network is irrelevant in this case because the original goal of Sparkassen-IT was the access of Sparkasse Sternenfels. Due to the saving potential by using the municipal pipelines, as already mentioned, access to the districts and industrial parks could be co-financed.

Planning costs in EUR	0	**Amount of granted aids in EUR**	0
Cost for building up in EUR	176,000	**Name of funding programme**	-
Municipal contribution in EUR	0	**Amount of additional financing means in EUR**	0
Network open to the market	no	**Refinancing of network (date)**	not specified

5. Conclusion

The example Sternenfels indicates the necessity to try for alternative or even outside-the-industry partners if established providers refuse cooperation. Contacting the Zweckverband Bodensee-Wasserversorgung and Sparkassen-IT finally made it possible to not only connect Hartchrom-Schoch, but also households and other businesses in Sternenfels.

3.2 Examples from an administrative point of view

In the category „administrative“ fall examples that show an exemplary project management on different levels as well as depict the role of the commune and other participants well.

Municipality of Grambow (MV)

By providing existing buildings such as the city hall or empty silos, local network service providers are able to provide solutions for few customers. The cooperation between communes and service providers encourages the realization of solutions.

County of Passau (BY)

The county of Passau was able to increase efficiency and effectiveness in developing broadband significantly by establishing a coordinating office and a central contact point for the district population and their mayors. It was important that all 38 communes pull together to speak with one voice when negotiating with service providers. Equally important was institutionalizing the exchange with the service providers by organizing regular and planning meetings. Developing a register for empty conduits helps to build synergies in civil engineering and laying of broadband networks afterward. Facilitating a district wide geoinformationsystem and coordinating offices eases inter-regional planning.

Municipalities of “Pfälzer Bergland” (RP)

Advantages of cooperation are clearly depicted in the example of the municipalities in the Palatinate hill country. A research of the necessity and feasibility showed at first the potential and the problems of the region. The resulting division of provision areas made it finally possible to connect municipalities in which no economic development was otherwise possible. By the means of a financial plan based on solidarity, in which all participants contributed the same amount, it was possible for small or economically weak municipalities to participate in the provision solution. See below for a detailed description of this example.

County of Pinneberg (SH)

The example of the Pinneberg district makes it clear, how with a coordinated approach the provision situation can first be documented and then by strategic planning sustainably be improved. The inter-municipal planning was conducted transparently and made cost reduction possible.

County of Potsdam-Mittelmark (BB)

Through a cooperation between municipal and service provider, duties can be delegated thus reducing the cost of connections for areas with low population density with only few people participating in connection. The price conscious approach is well covered in wireless technology.

Municipality of Stubenberg (BY)

Stubenberg shows that it is possible in spite of topographical difficulties to realize a wireless connection. The project can be refinanced within a short amortization period. With the support of local craftsman firms a fast paced development can be achieved.

Municipality of Twistetal-Gembeck (HE)

This example shows that there is a possibility for very small municipalities to get broadband internet access. Through private initiative a regional service provider was established. More areas were connected and the cooperation among participants led to a cost effective solution.

The factors influencing success can be identified as: initiative and commitment of citizens, detailed agreement process between participating parties, transparency of all steps in planning and implementation as well as using available infrastructure to reduce total costs.

City of Wernigerode (ST)
Through the initiative of the Harz university and cooperation of all participants (university, service provider, town and municipal councils), the demand and the infrastructure were documented and the first steps made towards closing the provision gap. At the beginning of 2009 it was decided that the work on all projects should be coordinated in a municipal broadband centre. See below for a detailed description of this example.

Municipalities of Pfaelzer Bergland

State

Rhineland-Palatinate

Area

440 km²

Population

53,000

Population density

120 inhabitants per km²

Areas with an unfavourable situation of premises can also be connected by careful segmentation and detailed planning.

1. Initial situation

The communities of Pfaelzer Bergland are located in the south-west of Rhineland-Palatinate at the Saarland-border. The 132 municipalities in total, cooperate in tourism and projects that improve the economic structure.

The service-area includes the collective municipalities Waldmohr, Schoenenberg-Kuebelberg, Glan-Muenchweiler, Kusel, Altenglan, Wolfstein and Lauterecken and the administrative district Kusel as well as the collective municipalities Bruchmuehlbach-Miesau and Meisenheim and also parts of the districts Bad Kreuznach and Kaiserslautern.

The name of the region already indicates that it is rather hilly and spotted with small forests.

Only some communities were supplied with DSL at a sufficient rate. Most communities only had access to bandwidth far below 1 Mbit/s or DSL wasn't available throughout the community. Neither upgrading nor extending the DSL network was sought after by the established providers. Very few communities had access to modernized TV-cable which allows broadband-internet connection.

Two providers of radio linked technology are operating in the area. The first provider covers seven communities. The second provider covers communities, but two of them are only partially covered.
Neither the radio linked service providers nor the TV-cable company had plans to develop the coverage.

At the start of the project there was a total of 46 fully covered communities, 40 communities that in parts were not adequately supplied (updated in parts), 38 not adequately supplied (DSL Light available in parts) and 3 not supplied (no DSL available). 5 communities didn't offer any information.

2. Scope and technology

Description of applied technology
The area to be supplied consists of a multitude of small local municipalities. To allow an economically reasonable development, these municipalities cannot be looked at as isolated units.
To cover the area soon to be supplied using a single local backbone with the corresponding broadband technology would require a major financial investment which many small businesses are not able to raise.

To allow for the development nonetheless, the communities were divided in 4 development areas based on economic, topographical and technical aspects. This allowed for the application of different technologies and a reduction of the overall cost. Each area would be supplied in the most cost effective way possible rather than being bound to one provider with its preferred type of technical infrastructure.

By defining those access areas it was seen to that an equal mix of economically attractive and less attractive communities was achieved to ensure supply of economically less attractive areas.

By splitting the area into four independent parts, and therefore projects, made it impossible to give technical details. Two companies are involved in the implementation. The four areas will each be connected to a separate local backbone.
The company inexio KGaA develops and provides the areas 1 to 3. This provider installs its own DSL-infrastructure. Pre-existing cross-connects are connected to broadband using directional radio technology. The connection between the splitter and the customer is supplied using the standard telephone lines.

A radio-only connection is supplied where the cost for a connection via cross-connect exceeds the financial potential. The forth area is accessed and provided by the consortium STUD IT and FGN (fundamental generic networking GmbH). A radio-only connection will be installed.
All areas will be operating in summer 2011 at the latest.

Information on speed as well as rating and pricing
The basic service offers 6Mbit/s downstream and 512 kbit/s upstream. It includes telephone service and a data flat rate. Customers will be charged €29,95 a month or €34,95 including a telephone flat rate Service with 16Mbit/s down- and 1Mbit/s upstream costs €39,95 a month, 25Mbit/s down- and 2Mbit/s upstream €44,95 a month, 50Mbit/s down- and 2Mbit/s upstream €49,95. A telephone flat rate is already included in these three options. The minimum contract duration is 24 month.

The provider in the fourth area also offers several options. The basic service, which does not include telephone service, offers 3Mbit/s down- and 256kbit/s upstream at €29,75 a month. This tariff can be chosen including a telephone flat rate at €37,50 a month. All options with more bandwidth than the basic service already include telephone service and flat rate Service with 16 Mbit/s costs €44,95 a month, 25 Mbit/s €49,95 a month and 50 Mbit/s €59,95 a month. The upstream rate for these three options is 1 Mbit/s. An additional €99 are charged upon installation. All tariffs include a ‚proper' flat rate Minimum contract duration is 24 month.

3. Project description

The communities in Pfaelzer Bergland are very insufficiently connected to broadband. Since it wasn't possible to supply individual communities on an economically justifiable basis, a joined approach of all municipalities in Pfaelzer Bergland was agreed on. The municipalities in the area to be supplied are closely connected to each other and do understand themselves as one region. A comprehensive agreement was formed amongst the municipalities. The Wirtschaftsservicebüro of the administrative district Kusel coordinates the project.

At first demand levels of all communities in Pfaelzer Bergland were evaluated. The results revealed that only 35% of all communities were sufficiently connected to broadband. 30% were connected in parts, 31% had no broadband available at all or at rates below 1Mbit/s. 4% of communities didn't provide data.

All municipalities, even those with sufficient broadband access, agreed to take part in a joint broadband development program. This offered 4200 households and 110 businesses as potential customers.

An interest determination procedure was held based on this data. It was the goal of this procedure to find internet providers that were willing to provide all municipalities with broadband, based on the number of potential customers. The minimal requirement for offers was a 3Mbit/s downstream rate (no specific upstream rate required) and a flat rate at no more than €30 a month.

The four offers presented all lacked economical responsible development costs (€400,000 to 600,000) and offered to supply some communities only or planned to charge fees for broadband service that exceeded reasonable prices especially for households.

The interest determination procedure was based on 83 municipalities that were interested in participating. This number was determined during the evaluation of demand levels.

After a registration period 76 of 132 municipalities agreed to engage in the project. Now there were 4,000 households and 90 businesses left as potential customers.

The coordinating office in Kusel then commissioned a feasibility study about the development of a broadband network. It was the intention of the study to evaluate the participating communities in terms of topographical, economical and technical aspect. Topographical aspects help to identify negative factors such as natural elevations that could cause problems in installing directional radio tech-

nology between to places. The evaluation of technical aspect shows if i.e. a backbone is available or if the is a grass fibre section nearby that could be used to install a new backbone.

The economic evaluation added information about i.e. number of potential customers and supply locations. Close attention was paved that each area of the four included communities with high as well as with low development costs. This should ensure the development of economically not attractive areas. Based on this information the 76 municipalities were split up in four areas. All of those areas were presented as separate projects to tender.

The bidding has been settled. The contract for the areas 1 to 3 were awarded to inexio KGaA, the contract for area 4 to the consortium STUD IT and FGN (fundamental generic networking GmbH) in Kaiserslautern.

The connections are expected to be ready for service in summer 2011. In areas 1 and 4 the first customers will get access this year. In the areas 2 and 3 the backbone-infrastructure has been installed.

4. Amount and type of financing

The financing was based on a solidly agreement. All municipalities involved contribute equally. This helped those municipalities with high development costs to be connected.

The administration of Kusel assisted in applying for subsidies. A total of €598,000 for all four areas was granted. The total costs of development cannot be quantified yet, neither the number of new customers. The subsidies will be paid to ensure cost-effectiveness. Due to this some amounts can differ from those estimated and the municipal funding in each area can‘t be numbered until the implementation is finished. The administrative district pre-finances all expenditures to avoid a financial overload of the municipalities.

Planning costs in EUR	30,000	**Amount of granted aids in EUR**	598,000
Cost for building up in EUR	not yet specified	**Name of funding programme**	State programme
Municipal contribution in EUR	0	**Amount of additional financing means in EUR**	0
Network open to the market	yes	**Refinancing of network (date)**	not specified

5. Conclusion

The example of the communities of Pfaelzer Bergland points out how beneficial a joint effort can be. By analysing feasibility as well as requirements, problems and potentials of the region could be identified early into the project. This resulted in splitting the region in four separate areas to also guarantee development of those communities that would not have been supplied from a solely economical point of view. By solidly financing this project, all parties contribute an equal amount, small and financially weak municipalities could participate.

City of Wernigerode

State

Saxony-Anhalt

Area

165.27 km²

Population

34,161

Population density

207 inhabitants per km²

Through the cooperation of the university, town and district councils, it was possible to at first determine the provision situation and then improve it step by step, through cooperation with internet service providers.

1. Initial situation

Wernigerode is a town in the district of Harz (Saxony-Anhalt). It lies at an altitude of approximately 250m in the Northwest flank at the foot of the Brocken. The east to west expansion of the town area plus incorporated towns and villages is 9.5 km, the north to south expansion is 6km. The highest point is the Brocken with an altitude of 1 141m above sea level and the lowest point is 215m above sea level. The city centre is in a valley and spreads out in the shape of a star with hills and mountains on the outskirts. In the south the town is surrounded by a forest.

A copper cable network exists that, due to the large distances between multiplier and household connections, only allows for a speed of 384kbit/s (DSL light). A glass fibre backbone that belongs to Vodafone D2 GmbH runs past the town area in the North. There are in addition two TV and/or coaxial cable networks which were partly modernised in 2008 to facilitate a use of broadband internet services. The development of UMTS data connections is only partly possible.

2. Scope and Technology

Description of applied technology.
There are two local exchanges in Wernigerode. These are located on the outskirts and provide only the nearby participant connections with a bandwidth of a maximum 6Mbit/s asymmetric or 2Mbit/s symmetric. Users that live further away from the exchanges and closer to the city centre attain a maximum of 384Mbit/s. In most cases 2 connection share a copper line which makes it impossible to use the telephone and internet at the same time.
Apart from that there are two network nodal points (also known as point of presence or PoP) that are part of a backbone network which belongs to Vodafone D2 GmbH. One of the network nodal points is used, inter alia, by the company TeleColumbus (in the Northwest of Wernigerode) to feed in services to the TV cable network and the other provides for the north west industrial area.

A further backbone of the BCC GmbH runs parallel to high and low pressure gas pipelines past the town. To provide firms and citizens with better broadband connections, the firm decided in September 2008 to lay a 7km long glass fibre cable to the innovations and founder centre located in the city centre and establish a network nodal point there. This new access has a symmetrical bandwidth of 622Mbit/s. At the beginning of 2009 the cable was extended to a further 3km from the newly established network nodal point to the industrial area Giesserweg and currently to „Robert Koch-Institut“ located in the city centre

The network nodal point in the innovations and start-up centre in Wernigerode offers 3 possibilities of connecting citizens and firms to broadband internet:

The first option was already implemented in June 2009. From the network nodal point a direction radio link (5.4 to5.8 GHz, 50Mbit/s, symmetrical) was established to the village Hasserode 3km away. The signal was then fed into the TV and/or coaxial cable network of the provider Heuer&Sack and currently provides 350 customers with bandwidths of 6Mbit/s and more.

The second option that still has not been implemented requires cooperation between the providers. It involves feeding the signal into the copper cable network of the Deutsche Telekom. For this a new active switching technology must be installed in the cable distribution cabinet.
A further option that could so far not be implemented involves extending the glass fibre cables from the network nodal point to the different boroughs so as to connect the Deutsche Telekom cable distributors better than they are currently connected. Apart from the cost intensive civil engineering necessary, a new active switch technology would be required making the realization of this plan only possible through partial funding.

Information on speed as well as rating and pricing
The rates of the three service providers (teleColumbus, Deutsche Telekom,Heuer & Sack) are oriented on the national average and are between €19.90 and €49.90 a month depending on the services used in a package and/or data rates.

3. Project description

At the end of 2007 the problem of missing broadband internet connections in Wernigerode was detected for the first time by the University of Harz. The communication expert at the university Prof. Dr. Ulrich Fischer-Hichert at first approached the town and or the business development department in Wernigerode. The responsible partners sought dialogue with service providers, however, this remained fruitless. The university further need for action and wanted to support efforts as a neutral mediator. Alternative solutions and partners were sought in a next step, which is how BCC GmbH was found. The firm maintains a back bone that access business customers and runs past the outskirts of Wernigerode. Since there seemed to be an interest for solution scenarios for private customers, the town council and carriers entered a contract in mid 2008 that held onto the development intention.

Parallel to this, the University of Harz embarked on a project together with the town that targeted mapping existing infrastructure and recording it in an infrastructure atlas. Special attention was paid to the network of a telecommunication service provider that had created empty conduits in the framework of an expansion in 2002 but was no longer on the market. After nine months, mapping existing infrastructure was successfully completed at the end of September 2008. A subsection of the local civil engineering department administers this data in an electronic system and gives individual export data (in PDF documents) to interested companies (Telecommunication service providers, power suppliers) at a fee.

Immediately after mapping was completed, the university initiated a second project targeted at investigating the availability of broadband connections in Wernigerode. In the framework of this project, the declared bandwidths provided by service providers were tested by sampling the bandwidths actually achieved by customers when sending and receiving data packages. Randomly chosen citizens were requested on the phone to test the internet speeds. The samples were substituted by own tests, questionnaires and internet research such that at the end of 2008, a geo-referenced overview of broadband-internet availability in Wernigerode was presented in the form of a research.

This research helped to specify the data in the broadband atlas of the Federal Ministry of Economics and to make a detailed division of provision areas as well as to cluster under serviced areas. The results showed that there were two areas that were under serviced (less than 1Mbit/s). An additional necessity analysis, via direct mail, was done in these areas. The results of the necessity analysis matched the availability. It was noticed that enquiries via direct mail were more successful (20% to 30% response rate) than enquiries in the local gazette (approximately 5% response rate).

The efforts of the University of Harz to improve provision of broadband services were characterized in different project titles. Internally the responsible work group was named „broadband centre“. At a mayors‘ conference on the 17th of December 2008, the official founding of a broadband centre for the entire district of Harz was resolved based on the presented research results. The participants were, apart from the university and Harz Optics GmbH (development of LED and

glass fibre cable technology, the district business development authority as well as the innovation and start-up centre (IGZ) who provided financial resources.

In another mayors conference on the 29th of April 2009 the founding of the centre was confirmed and an advisory council was elected to monitor the activities of the broadband centre. In addition, first responsibilities of the broadband centre were defined. Advising the communes in the district in matters of technology and financing as well as other planning services which involved completion and updating the infrastructure were the first responsibilities assigned.

4. Amount and type of financing

The evaluation of the infrastructure, availability and the operation of the broadband centre caused costs of about €60.000, mainly for personnel. These were covered by the administrative district Harz and Wirtschaftsförderung (city of Wernigerode) in equal shares.

The service provider spent about €160.000 for 7km of glass fibre cable which was installed by BCC GmbH. The broadband centre estimates that the gradual development of broadband internet in Wernigerode will produce costs of about €1.000.000 over the coming years.

Planning costs in EUR	60,000	**Amount of granted aids in EUR**	0
Cost for building up in EUR	so far: 160,000	**Name of funding programme**	-
Municipal contribution in EUR	60,000	**Amount of additional financing means in EUR**	0
Network open to the market	yes	**Refinancing of network (date)**	not specified

5. Conclusion

Due to the initiative of the Hochschule Harz/ University Harz and the cooperation of university, provider, municipal administration and district administration is was possible to evaluate needs as well as existing infrastructure in Wernigerode. Initial steps to fill the gaps could be initiated. In early 2009 one decided to form a broadband centre for the administrative district to coordinate the project.

3.3 Examples from a technological perspective

The 13 best-practice examples introduced in the category „technological“ are special in terms of technology used and it’s implementation.

Municipality of Heiligkreuzsteinach (BW)

The following example shows, how a pragmatic approach from the municipality can lead to finding a fast provision solution in difficult topographical terrain. The possibility of utilizing the roof of the city council and an information meeting that points out the necessity of commitment from the citizens (for example letting the roof of property as an antenna location) made a solution possible. The basis of cooperation was trust between citizens and service providers as well as a neutral explanation from the municipal council on the technical possibilities.

Hochsauerlandkreis (NRW)

The founding of a broadband initiative in Hochsauerland district and its resolute approach made it possible to provide, almost in blanket coverage, broadband access in a large and topographically challenging district. Where access was not profitable for large network providers the connection was made possible by the “Telekommunikationsgesellschaft HSK mbH”. See below for a detailed description of this example.

Municipality of Lüdersdorf (MV)

Through a coordinated approach and support from the citizens, the necessity was determined and quickly put up for tender. The solution found offers a cost effective and scalable alternative that is feasible in a short time despite unusable network infrastructure.

Hanseatic city of Lueneburg (NI)

The town of Lueneburg was able to access all municipal real estate cost effectively by laying their own glass fiber network. The gradual planning of five construction phases made it possible to act target oriented by taking the needs of each connection participant into consideration.

Municipality of Markersdorf, districts Jauernick-Buschbach and Friedersdorf (SN)

The best practice example from Jauernick-Buschbach shows clearly how the passionate initiative of one party can lead to move and lead to success for an entire region.

Municipality of Marktrodach (BY)

The Marktrodach example can be a role model all over where TV cable network is available. Specifically the research of citizens and the timely initiative of the mayor helped to identify the existing infrastructure as an opportunity for the region. Through open negotiations between Kabel Deutschland and the municipality it was possible to find a solution that was advantageous to all parties involved. The comprehensive offer with internet, telephone and television connection at affordable cost led to high acceptance by the population. The scalability of the solution was looked into right from the start. New connections can quickly be installed when needed at low cost. See below for a detailed description of this example.

Municipality of Namborn (SL)

The regional network provider “Intersaar GmbH” with many years experience in the mobile network sector was quickly able to win the confidence of the municipality and citizens. Any reservations towards radio linked access were eradicated quickly through personal contact. By

use of radio technology it was possible to access comparatively few households in a topographically difficult setting. The use of a cost effective technology essentially contributed to the success of the project especially for regions in which electricity was not available. By means of a low electric need and the use of solar panels as well as already existing installations, a high potential connection was established.

Municipality of Salzhemmendorf (NI)

By means of comprehensive technical planning and use of existing cable infrastructure, the municipality of Salzhemmendorf managed to establish a radio based broadband internet access despite topographical issues. The near to blanket coverage of the settlement area was realized in only four months at no cost for the municipality.

Municipality of Sasbachwalden (BW)

When all other options could not be realized, that was when one started looking for own solutions. Feasibility research and assistance made it clear that it was better to build a glass fibre network than to modernize the existing network. The use of drainage system pipes and overland circuits when laying the cables reduced costs.

Five municipalities in „Schwäbischer Wald“ (BW)

The use of radio links by the solution provider made it possible for the first time to provide remote municipalities with fast internet access. Bundling the demand and using existing (copper cable-) infrastructure lowered the connection cost.

Region Wasserburg with municipalities of Soyen, Babensham, Edling (BY)

The firm mvoxAG achieved a significant increase in distance of end user from the main multiplier by use of an alternative technology. This technology led to an improved provision especially for urban outskirts.

Markt Werneck, Gemarkung Vasbühl (BY)

The example from Vasbuehl clearly shows that through the initiative of a service provider a quick provision of broadband access in rural areas can be achieved. Directly contacting the municipality and the possibility of building a profitable network even with few participants were the clinchers to success. This kind of solution can be looked into for small municipalities where distances to neighbouring areas are large and a short term remedy is needed.

Werra-Meissner-District (HE)

Through a combination of different technologies and with the help of existing infrastructure, it is possible to install economical networks with short refinancing time at municipal level. It is hereby important to take note of the fact that a sustainable technological development for all regions with WLAN provision is planned and with that the bandwidth for the user can be considerably increased without any additional cost.

Hochsauerlandkreis

State

North Rhine-Westphalia

Area

19,588 km²

Population

271,891

Population density

142 inhabitants per km²

The implementation of a mix of technologies led to the connection of the district and a long term migration strategy is pursued on the way to next generation access.

1. Initial conditions

The Hochsauerland district with its 12 towns and municipalities is with 1 958.8 km² the largest district in North Rhine Westphalia. The settlement density varies greatly in the district, rural areas with low population density alternate with urban areas. A characteristic of this region is the low mountain range landscape with an altitude between 145m and 843m above sea level.

The broadband provision was rather irregular. The urban areas had broadband access, but the provision in the outskirts of urban areas and in the rural areas was often inadequate.

2. Scope and technology

Description of used technology

Broadband provision in the district of Hochsauerland was established using a range of different technologies. In the framework of this as an example for best practice however only the use of the radio linked solution will be looked into. A comprehensive depiction of the entire „broadband initiative of Hochsauerland district“ can be found in the respective final report.

The radio linked solution used in Hochsauerland district is a directional radio backbone that annularly draws through the entire area of the district. This composite provides for 40 local networks. In the local networks, customers are connected using one or more distribution stations with a further radio linked solution. The composite has two provision points that are independent of each other, the so called points of presence (PoP) where an internet connection each with up to 800Mbit/s is fed into the grid. From these provision points a signal is distributed by means of directional radio via 10 masts over a distance of approximately 120km across the entire district. The choice of location for the masts is thereby of vital importance for the number of local networks accessed by each mast. This is especially the case in the Hochsauerland district because the terrain (very hilly and

forested) is decisive for the number of masts. The annular arrangement of the radio linked network and the feeding into the grid at two points of presence achieves a redundancy and a high provision security.

The local networks are connected to the composite via a further directional radio link. Within the villages a radio linked solution (pre-WiMAX, 5.8 GHz) is used to distribute the broadband signal. The signal is radiated by one or more 120-degree-sector antennae in the direction of the customer and is received by outdoor antennae, which is in line of sight to the local radio mast.

Information on speed as well as rates and pricing

Two rates are offered to private customers. Both have minimum contract duration of 24 months and a flat rate. The L net private rate offers a speed of 6Mbit/s downstream and 1.5Mbit/s upstream. It costs €34.95 per month in addition to a one off connection cost of €99.95.

Firms are offered tailor made solutions at a net rate from €199.00 per month. The speeds are in this case from 2Mbit/s to 155Mbit/s

3. Project description

Since the year 2005 the district of Hochsauerland has been keen on developing a blanket coverage of the district with broadband infrastructure.

As a first step, a research to the generation of a broadband infrastructure was commissioned in the Hochsauerland district. In the framework of this research a first necessity analysis was drawn in which the needs of 1000 firms in the district were depicted. Furthermore recommendations for action were stated which contained a 10 point programme whose first recommendation was to establish a broadband initiative.

On the basis of this recommendation a broadband initiative in the Hochsauerland district was founded which became henceforth the organ that represented the interests in matters around broadband technology. The essential duty of the initiative was to coordinate the efforts as well as run technically neutral negotiations with solution providers and give recommendations for action.

The district assembly and district board unanimously followed the recommendations of the initiative of Hochsauerland district to target a blanket coverage of internet services with a fixed minimum standard of 2Mbit/s for private households in areas that were hitherto un-serviced or under serviced.

When the initiative started its work, service providers were asked, on the basis of the necessity analysis, to expand networks. The result was that some areas of the Hochsauerland district were accessed by established service providers that used TV cables to provide DSL and broadband services.

In order to find solutions for areas that were unprofitable for providers, an idea competition was carried out in which many companies could present their concepts. From cable TV, satellite, glass fibre to power line and mobile radio,- many alternatives were presented. After evaluating the advantages and disadvantages of the different technologies and con-

cepts, a decision was made. From the 12 submitted ideas the radio linked solution of the innofactory GmbH was chosen because it had the best potential for application in all of Hochsauerland district.

For the connection of hundreds of firms and thousands of citizens who so far had no or inadequate broadband access, a detailed network planning was done and, based on past experience with radio network, a calculation of cost and expected revenue for each village was made. Beside clarification of matters on technology, law and finances, a business model had to be developed that fulfilled all legal and economic requirements.

Because the commune is not allowed to run any business with end customers but can implement infrastructural plans or run communal telecommunication networks, the district council of Hochsauerland decided to found the Telokommunikationsgesellschaft Hochsauerlandkreis mbH. The necessary development of infrastructure in town and villages in the district area were pre-financed using district funding. The business model of the telecommunication association is based on owning the network infrastructure which is then rented out to private network and service providers.

After successfully developing the infrastructure the first local network went into operation on the 1st of October 2008.

4. Amount and type of financing

The cost of the development was entirely borne by the Telekommunikationsgesellschaft HSK mbH (only associate: the district of Hochsauerland). The revenue generated by renting out of the network by the association serves at first to refinance the investment. The profits will then be used to further develop the broadband infrastructure after the break-even point is reached.

Planning costs in EUR	550,000	**Amount of granted aids in EUR**	0
Cost for building up in EUR	2,700,000	**Name of funding programme**	-
Municipal contribution in EUR	2,700,000	**Amount of additional financing means in EUR**	0
Network open to the market	yes	**Refinancing of network (date)**	60 months

5. Conclusion

It has been achieved, through the founding and rigorous approach of a broadband initiative, to provide the large and topographically challenging district of Hochsauerland almost entirely with broadband access. In areas where provision by a large network provider is not profitable, the Telekommunikationsgesellschaft HSK mbH provides connection.

Municipality of Marktrodach

State

Bavaria

Area

33.33 km²

Population

3,950

Population density

119 inhabitatns per km²

Through the own initiative of the citizens of the municipality, existing infrastructure was able to be used to ensure blanket provision of high bandwidth.

1. Initial conditions

Marktrodach in a municipality in the district of Kronach (administrative district Oberfranken) and lies about 6km east of the town Kronach. The municipality lies at the western border of the district in the Frankenwald national park. The area is hilly and the surroundings are forested.

The citizens in the municipality researched their broadband provision possibilities in the region. The broadband provision of the area was with 40% coverage very poor such that many citizens campaigned for development and embarked on the problem.

2. Scope and technology

Description of used technology.
For the development, existing TV cable network was fallen back on. To retrofit the available TV cable structure to a broadband network, the active component of the repeater as well as the central technical services were replaced. Modifying the repeater and head-end station is necessary to facilitate upstream channel capability of the cable network. The upstream capability is necessary so that users are not only able to receive data but also send. Beside the TV channels it was also possible to offer new services. It was this possible to offer Telephone, internet and TV services using one cable. By upgrading the „old network“ at key points, it is now possible to make use of new services in all areas that were previously only serviced by a conventional TV cable connection .

Information on speed as well as rates and pricing
According to the service provider, download speeds of up to 32Mbit/s and upload rates of 2Mbit/s can be achieved in Marktrodach, independent of distance to the next multiplier. The best-selling internet product is „comfort package“ (in-

ternet and telephone flat rate) going for €22.90 per month. The „classic package“ (also a double package) with 6Mbit/s downstream and 460Mbit/s upstream costs €12.90 per month at the moment. Apart from that there is a single package for telephone or internet services from €9.90 per month. According to the administration and customers, the stated average rates are achieved. The cable modem required for use is made available free of charge by the service provider.

3. Project description

Due to the inadequate provision with broadband internet services, individual citizens vehemently campaigned for the development. This happened by use of letters to the first mayor of Marktrodach. The mayor then decreed in April 2008 that a present situation analysis and need analysis be conducted in order to quantify the need.

To carry out the analysis a questionnaire especially designed for this purpose was sent to the entire population. After the necessity analysis, the municipality contacted three service providers. Two of the three service providers offered solutions that could be implemented with the help of government funding. Kabel Deutschland also offered to negotiate. With the help of the necessity analysis, it was easy for Kabel Deutschland to take note of the fact that TV cables were available in many buildings which did not have broadband connection.

It turned out that using the existing cable network in a classical coaxial design could provide approximately 1,460 of the 1,750 households with broadband. Through an individual tuning, employees of Kabel Deutschland and the mayor of the municipality came to the conclusion that upgrading the existing TV cable network to a broadband network would be profitably possible.

Essential for this was that under-serviced municipalities already had TV cables. The existing cable networks could be modified without large scale civil engineering being necessary. Important for the success of the project was the large number of potential customers that made the modification profitable.

4. Type and amount of financing

This example of best practice can be looked at as a model of economic success; however the economic success is ascribed to existing infrastructure.

Planning costs in EUR	not specified	**Amount of granted aids in EUR**	0
Cost for building up in EUR	not specified	**Name of funding programme**	-
Municipal contribution in EUR	0	**Amount of additional financing means in EUR**	0
Network open to the market	no	**Refinancing of network (date)**	not specified

5. Conclusion

The Marktrodach example can be a role model for all regions that already have TV cable network. It can be taken note of that TV cable networks are not only available in urban areas but also as the example shows in small municipalities. The research done by the citizens and the mayor's timely initiative helped identify existing infrastructure as an opportunity for the region. By use of the transparent negotiations between Kabel Deutschland and the municipality a solution was found that was advantageous to all participants. The factors determine the success can be identified as follows:

I. The initiative of the citizens in on-site research and the high participation in the necessity analysis that helped the commune identify and quantify their problem.

II. The use of existing infrastructure and the carefully weighing out of the modification cost against the expected revenue were deliberately used in the cooperation between solution provider and Commune.

III. Open and direct negotiations between solution provider and commune led to mutual understanding and quick clarification of details.

IV. The holistic offer of internet, telephone and TV services using one network at affordable prices was widely accepted by the population.

V. The scalability of the solution was considered right from the start. New connections can be made available when needed with little effort and at low cost.

3.4 Other best practice examples

The category „other" contains examples that are not readily and entirely transferable due to, for example, special initial situations. Still, these projects show interesting approaches for examples in technological or financial arrangements which could offer impulses to projects that are looking for suitable solutions.

County of Bamberg (BY)

The county of Bamberg collected all relevant data and information on time. From the beginning, the needs of citizens and firms were observed together with the communal infrastructure for example of city halls, schools etc. The plan was to achieve cooperation at municipal level from the start. In doing so it was possible to identify not only the regional infrastructure but also the needed number of customers to run an economical network. The cooperation between a number of communes, as in this example, leads to approach of solutions that none of the communes would have had at their disposal if they stood alone.

Grafschaft Bentheim (NI)

With the open glass fibre nodes in Nordhorn, the Grafschaft Bentheim district aims at competition at service level. This promising approach is already bearing fruit and will secure the firms in Nordhorn future-proof broadband internet access. Through complementary arrangements and division of provision areas it has been achieved that provision gaps in rural areas could be closed.

Counties of Heidenheim, Lörrach and Rottweil (BW)

With the comprehensive collection of infrastructure data and necessity in the three municipalities it is possible to depict the provision situation accurately The bottom line of this data collection are the foundation for future plans.

4. Conclusions

The conclusions are a result of the analysis of collected data about best practice examples. For this experience of the interviewed persons were taken into consideration, content coherence was analyzed, assertions were interpreted and statistics drawn.

The 30 best practice examples introduced in this research depict a cross section of the problems and successful solution approaches that are known in Germany when it comes to broadband infrastructure. They are representatives for a large number of activities and are also meant to give impulses for future plans.
When reading the examples of best practice, the contextual and exercising diversity which project participants are exposed to becomes clears. It is evident that there is no universal solution for the problems surrounding providing a blanket coverage of broadband internet access. The time consuming and content planning phases in most of the examined projects is a convincing indicator.

It is remarkable how important knowledge in detail of regions, information on firms and corporations as well as contact to them is. In most of the examined examples, the communal council assumes the role of a coordinator even when it is not the initiator of the expansion. In a few cases though, the infrastructural problem is solved by local participants through corporate of private commitment without the involvement of the communal council.

It shows that information on existing and usable broadband infrastructure (e.g. towers, property roofs that can be used to install antennas) in a region is easily and quickly acquired through cooperation detail knowledge and contact to firms. In this way, almost half of the examples of best practice were able to use existing infrastructure. Apart from the saved costs, it had a notably positive effect on the time taken to build the networks.

For all projects, two main phases were identified: on one hand the planning phase, during which information on an existing provision problem and setting up a necessity and feasibility analysis up to contracting public and private coope-

ration partners and on the other hand, the actual building of infrastructure that lasts from „first spade“ until the customer has broadband access.

The durations of the projects clearly differ in the analyzed examples. Different factors play a role in this. Apart from the size of the regions (areal dimension and size of the population), the technology used to provide network also plays a decisive factor. Wireless and radio supported solutions were realized faster than access using cable connected network. Broadband connections based on radio solutions were installed partly in extremely short time, sometimes a few weeks were all that was necessary.

Different topics and fields of action emerged during the analysis which are relevant in realization of the projects. To those belong e.g the general challenge participants have to take on locally. But also the necessity of market analysis, feasibility studies and information events with good publicity is evident in all examples. The analysis of the different topographical conditions and the choice of technology in each case as well as the different models and options of financing that are used are very interesting. The structure of the firms that are solution partners in building the broadband infrastructure give interesting additional insights in the possibilities that are available to rural areas with low customer potential.

4.1 Challenges for project participants

Challenges encountered by solution providers and project administration became clear in the course of analysis. Reservations from the population as well as from decision makers and members on communal councils concerning certain technologies are to be expected. Apart from that, financial aspects play a big role e.g communes often have very few employees, a disadvantageous population structure or the financing of the actual construction activity with suitable partners.

For both the commune as well as for the providers of professional solutions the expectations as well as the reservations of citizens towards the expansion of broadband are relevant. This helps to detect the reservations of citizens towards especially radio technology which is said to be notably less reliable. But also health concerns play a not to be underestimated role. The skepticism of citizens is often a danger to realization even when radio is the only technical and economic option that is available. The necessity of information is usually covered by the project administration and solution providers in information events.

Even in communes there are cases of reservation towards wireless technology. The main reason was often the fear that a reliable radio technology would reduce the probability of building a glass fibre network for the region in the future. This fear was not confirmed in any of the projects.

A few, especially small communes are often very restricted in their possibilities and cannot relieve qualified personnel from duties or employ one to look into solving the provision problem. It became evident that examples of best practice in which cooperation at communal or municipal level was coordinated, resources and competence could be bundled and thus used targeted and efficiently.

One other challenge that is not to be underestimated in the planning and implementation of infrastructure expansion in broadband is the structure of local and regional population. Especially in regions with a high average age, a lot of effort is required from the project management to win potential customers for broadband access. The number of potential customers related to the number of under serviced households is even lesser than it already is in rural areas. This has a negative effect on the negotiation position of the commune or municipality as opposed to potential solution providers who put a limit to the least number of potential customers as a condition for economic activity. In these cases it puts the responsible people in the difficult situation to increase the demand and negotiate smartly with service providers.

How far a region stands up to the individual challenges and overcomes these, is a direct factor for success and for the feasibility of the entire project.

4.2 Demand analysis, feasibility studies and information events

It is striking that in almost all successful projects sound research was carried out to analyze the demand for broadband internet access that involved the local and regional population as well as local and regional companies. Only 8% of the examined projects did not determine demand beforehand. While such a demand analysis is a prerequisite for projects that are government financed, many free financed projects recognized the advantages and necessity for such an analysis. With the help of the demand analysis it is possible to tell the quantity of broadband connections needed. Moreover the qualitative expectations of potential customers on their broadband network especially on expected bandwidth, security of the network and the internet services available are defined. Important indicators for the necessary and possible size of the plan can be derived from such results. A cost estimate of the construction is made easier with the help of a demand analysis.

It is important for a demand analysis to be well prepared and to be accompanied by good information politics. As some of the projects show, the analysis can wake expectations in citizens and companies that cannot be reduced later on.

The second step on the way to realize a project successfully is carrying out feasibility studies. With the help of this research general, technical, economic and periodical possibilities are identified in order to develop the right solution for the respective region. It is evident that feasibility studies are necessary especially for large projects (vast area, high number of potential customers, large-scale construction efforts to provide necessary infrastructure etc.) to examine the feasibility and necessity of local and regional initial conditions that are relevant and there can lead to success in a special way. In over 60% of the examples of best practice a feasibility study was done. The necessary financial and personnel efforts eventually had a positive effect on the costs of the respective projects: assignments could be described faster and more precisely and then be awarded. Possible obstacles and problem areas are identified before construction starts and can be taken into account; the necessary local information policy to citizens, companies and investors can be impelled in a focused way.

Information on the planned projects and those already running are very important to citizens and companies, who through monthly contracts see to it, that such a broadband network can be and stay financed. Focused information events were carried out in over 50% of the cases. The incentive was from the project management as well as from solution providers. The extra effort at the beginning relates positively to the targeted results because informing potential customers and actively advertising for the broadband construction can lead to an increased demand and with that lead to a higher profitability for the network.

4.3 Topographical conditions and choice of technology

The topographical conditions in a region are a central element of the specific framework of a project because they influence the possibility of implementing certain technologies. Barriers such as rivers and forests are to be taken into consideration. Stony ground makes necessary digging difficult and hills can make sight connections impossible.

And yet: Against all odds it was quickly clear that radio solutions are surprisingly often used in hilly areas because the peaks are suitable locations for radio masts to cover provision for large areas in valleys. The combination of radio and cable linked solutions are used especially in areas with varying altitudes. Laying the cables is a big problem in these areas and is usually only considered to be part of a possible solution. In regions with lower differences in altitude, cable linked technology was often used. In such areas the advantages of a cable network outweigh such as the higher potential, a better scalability and durability of used hardware.

Also forests in the regions being provided for did not lead to ruling out a radio solution. The results of the research show, that the use of radio technology was used here more often than in regions with no forests. In these cases, a feasibility study gave necessary information on the possibilities of specific technologies offered. While the structure of terrain evidently had a great influence on the choice of technology, there seemed to be no connection between population density and used technology. The size of region and settlement density do not allow for any conclusions on the frequency of the different broadband technologies used. Radio technology, as well as cable linked technologies were equally and successfully built in large areas and in geographical small regions.

4.4 Financing: opening markets and funding.

Financing the set up or the modernization of broadband infrastructure in an essential part of all examined projects. This entails besides identifying funding possibilities and the search for suitable financing and investment partners also guaranteeing future financing possibilities and financial security for funded projects is usually opening the network to the market a binding aspect. Still, many privately financed examples showed a similar open market structures. Differences in used technologies were not observed. The results and information from project participants leads to the conclusion that opening to competition is not an obstruction to successful and economically sustainable construction of a broadband infra-

structure. Quite the opposite. Usually the profitability was improved by collection of revenue for using the channels
For the predominant part of the successful projects no funding was used. Only 39% of the projects were realized with the help of public funds. The percentage of funded projects of all realized expansion activities across Germany should be lower than depicted in this study. This is essentially because of the better documentation of funded projects which is part of the requirements for funding for monitoring purposes.

In the examples in which funding was used, the percentage from funding was 21% of the total financing. That should not belie that the individual percentage of the funding in the legal financing of the project greatly differed. In terms of duration until refinancing the infrastructure there are partly extreme differences between the projects. The main reason is the different investment costs for the different technologies. Particularly the construction of FTTH comes with comparatively high costs. Thus the duration until refinancing could be 10 to 20 years. Radio linked network on the other hand can be run profitably in one to three years.

4.5 Solution partners of communes and regions

A central role in the examples is taken up by the solution provider that constructs the broadband infrastructure in the under serviced region and services it afterward. The solution partners of the municipalities or districts were often small and medium scale businesses. Only in 9% of the examined projects did a large business participate in construction of infrastructure. In few cases the broadband expansion was carried out by businesses with one to nine employees, called smallest instrument.

In many of the examined examples beside the solution partner firms from the regions were involved in accompanying activities. In infrastructure expansion different competencies are required which can be well catered for by local firms such as landscapers, roofers and electricians.

In general it can be said that small and no-name solution providers are eyed with suspicion. Well known large service providers on the other hand usually enjoy a certain confidence rating. This also applies to large businesses whose primary area of trade is not provision of telecommunication services, but have regional name recognition for example Stadtwerke (public utility company)

A similar effect can be observed is a respect to the used technology. Unknown technologies are observed with more skepticism than known broadband technologies such as DSL. Marketing titles such as „radio DSL“ could lead to wrong interpretation because DSL is used here as a synonym for broadband to gain consumer confidence. It is in this case not a description of the used technology.

4.6 Contracts and access prices for customers

Pricing and contracting also plays an important role in the construction and expansion of broadband infrastructure because it has a great influence on customer satisfaction. At the same time it is easier to win over new customers with attractive pricing which is compulsory for viability and future orientation especially with small networks. Generally speaking: Costs for the customer grow with an increasing bandwidth. This was, as expected, proved in the examined examples. And still when the regions are compared there are huge price ranges for the different products.

A comparison of the average prices (in EUR) in the examined examples with the European and German average prices, shows that also the mostly small solution providers were in a position to offer not only competitive prices but were also able to offer prices lower than the average. Only the prices of high bandwidths (in German comparison) show an upward shift. Many service providers have separate offers and price lists for companies.

One off connection costs are charged in most cases for the access to network and provision of the necessary technical facilities (e.g. router). The amount of collection fee is in most cases dependent on the duration of the contract and reduces the longer the contract duration.

Profit expectations are seen to differ according to the technology used. The limit for profit expectation is at clearly fewer customers with radio linked solutions than with cable linked solutions. The assumption is obvious that this has a lot to do with the initial investment. In the case of a radio based solution, each connection is created when the customer signs a contract with the provider. Cable linked solutions have to provide a connection even when a contract has not been signed. Laying a cable after the contract has been signed would cause higher costs.

The customers have exact expectations on the conditions of contract when it comes to contract duration and price and would like high flexibility. The expectations of citizens when it comes to design of a contract do not necessarily match with the profitability calculations of the service provider. A long contract duration especially for small providers is necessary in order to provide secure financing. This is often annoying to customers especially because of the fast developing technology and falling prices in provision of telecommunication services.

5. Recommendations for actions

The environment analysis of successful broadband projects provide clues for general options of action and factors determining success which were helpful or even crucial for the realization. With the keywords „recommendations for action“ different approaches will be derived, possibilities and also indicators will be combined. For a better overview the recommendations will be divided into the categories administrative, economic and technological.

5.1 Administrative approach

The administrative area has twofold importance. It is first of all important that the public administration takes on an active role in project development and carrying it out. The communes or district administration has the job of bundling all essential contacts and interests and organize them at the operational level. The second component is the administration of the project itself, which can be assumed by another participant (public or private). Herein lies the greatest potential to influence progress of the project through good coordination and efficient project management in order to bring the project to successful end. The essential aspects are:

Identify local participants

Straight at the beginning of a comprehensive and extensive project it is important to find local and regional supporters who can make a productive contribution in the establishment of broadband connection. Beside the communes and other public agencies, especially municipal associations, chambers of industry and commerce as well as citizens initiatives and mid range businesses take on an active or advisory part. Also regional and local supply and disposal firms (water, drainage, power) are worth considering as partners in a broadband project.

Information and awareness rising campaigns

Sensitization of the population about the different aspects of expansion of a broadband infrastructure is one of the core responsibility of the administration which should be embarked upon as early as possible. It is about a focused information of

citizens about the possibilities, costs and advantages. In order to generate general awareness about the current provision situation and possible perspectives, to bundle demand and organize participation there, information events should be organized on a regular basis. This makes the approach of the commune transparent, providers can present their solutions and confidence can be built.
It is also helpful to establish a work group for regional and local decision makers, company representatives, associations and citizen's initiatives that meet regularly. The work group should prepare decisions, deal with the solutions in detail and operate as multipliers.

Assess need (Demand analysis)

At first, the existing provision situation and the need for broadband internet connection should be investigated in the affected settlement area. A questionnaire is a good possibility to achieve this. Using local media is a good way of creating awareness of the requirement analysis and can increase participation in the survey.
The inquiries of individual citizens can be bundled to form solid demand on the basis of which service providers can make their calculations of profitability. Talks face to face with companies and public associations supplement the demand analysis because these customers often have special expectations on a broadband connection (security, speed). Positive side effect: A personal talk awakens the interest for initiative and active participation of the companies.

Developing action plans and setting priorities

It is very important for the planning and realization of sustainable broadband access to know ones goals and to assess their realization realistically. It is therefore important to develop a regional plan of action in which the duration, area and political priorities are defined. A consensus of participants and decision makers is essential so that, for example, a mixed calculation and the profitable running of the entire network remain possible. Apart from the general expansion goals and establishing a sequence for expansion, short, mid and long term plans as well as temporary measures (needs of a questionnaire) and ongoing assignments (infrastructure atlas) should be defined.

Availability analysis and infrastructure atlas

In order to realize development plans as efficiently as possible, it is important to register existing infrastructure and verify availability. The use of existing infrastructure (e.g public property used to mount antennae, empty conduit systems, private mobile radio masts, wind turbines, sewage pumps as electricity supplier for multiplier, existing glass fibre or television cable networks) can save time and investment and in so doing increase the diversity of solutions.

The intentions of telecommunication service providers should be inquired within the framework of an availability analysis. Large firms need larger bandwidth and usually have their own broadband connections or have broadband connections that are made available in a basic agreement which is independent of the regional provision situation. The possibility of cooperation should be determined in talks. Future expansion plans or joint possibilities for use can be aligned in this context.

Creation and use of an infrastructure atlas are especially suitable to support future and long term plans and investment decisions. An infrastructure atlas should document existing infrastructure (trans-

mission lines, infrastructure resources, infrastructure of other service providers, number of households and buildings etc.) as well as the future plans (for example civil engineering on streets, creation of building space, maintenance works on channels, bicycle paths etc)

Use of geoinformation

Geoinformation systems should be used to increase precision in planning and to prepare the basis upon which a decision is made. A broadband registry originated from the data of the need analysis, the availability analysis and the infrastructure atlas, and a lasting foundation for planning in the future is established. A broadband registry should be set up extensively, especially when large construction projects, such as motorways or country roads, could influence the accessibility of a region. Even when an own registry cannot be created, the information should be recorded in digital form and geo-referenced.

The conditions for the use of map material and geo-referenced data should be agreed upon in written form with the provider. Declarations of consent that define the reason for data use are advisable and so is a declaration of confidentiality towards service providers and other data providing sources. A simple alternative is the possibility of using systems such as Google Earth. Building data or information on how high a building is can be collected at low cost using commercially available navigation devices or a hand held -GPS devices so as to work them into a GIS.

Interest determination procedure.

The interest determination procedure is a call for tenders in the level of the expected economic gap and by doing so retrieve information on the economic risk. An interest determination procedure should give information about the deployed amount of subsidy, the technical approach to the solution and the number of new connections possible.

If the offers solicited in the interest determination are used to apply for funding, it has to be made clear that the offer has to be binding for a given period and what time schedule the development is subject to. This can be used to establish liability for the commune on one hand and give the service provider security in planning.

Feasibility studies.

In a feasibility study, the scope, the means and the time in which a project can be realized are determined. Possible discrepancies between the goal of the projects and already existing knowledge are examined. Tangible expansion scenarios are depicted and a technical and economic implementation plan can be drafted with the help of feasibility studies. They should be bound to the possibilities in the market and should take regional strategies into consideration.

Inter-communal cooperation

The cooperation of many communes and all municipalities in a district or larger units increases directly the number of customers and with that the possibility of finding an economically sustainable solution. This makes the region in question more attractive for the solution provider. The individual initial conditions of participating communes and districts are to be taken into consideration in order to minimize difficulties.

Establishing responsibilities

Like in all projects it is also important in the expansion of broadband infrastructure to determine clearly the function of each participant. This avoids duplication

of effort, delay, competence struggles and an inadequate flow of information.
Appointing a broadband coordinator is for example necessary to ease communication for outsiders, especially internet providers. In the depicted examples of best practice, the responsibility for the topic broadband was mostly given to the business development department of municipal councils or district administration, technology centres and building authorities also took over this responsibility. The division of roles between communes and districts is significant. Leadership of the project should first be appointed even though this appointment does not have to remain constant during all the stages of the project.

Communication and definitions

In many cases, broadband projects fail during the first attempt because of misunderstandings and communication problems, because a large number of participants from different areas in topic and expertise are involved in opening communes and regions. It saves time and reduces communication effort when terms and conditions of projects are clearly defined during preparation and tender. It is thus essential that those responsible for projects deal with the terms necessary.

It is also important not only for administrative reasons and not only for the project coordinator to document project progression as gapless as possible. This way, misunderstandings are easily dispelled or cleared up. The documentation of talks but also recording successful as well as failed approaches to possible cooperation partners and service providers can be of great advantage in comprehensive plans and can be obliging.

5.2 Economic perspective

From an economic standpoint, economic operation of a broadband infrastructure is an essential factor of success. The profitability of an internet network depends on many factors which on one hand comprise of geographic, demographic and technical initial situation of the specific municipality or region and on the other hand is dependent on factors that can easily be influences such as the choice of the right service provider and suitable technology.

The main aspect of a profitability study are the investments which are to be reduced in under serviced regions as well as operational costs (e.g. personnel, main switch and long term maintenance of network) and the scalability of the offer (the ability to expand the network) so as to guarantee a forward looking business. The aim is always secure operation of a network at affordable prices for the customers.

Financing the expansion projects is an also an essential factor that should be looked into early. Interim financing from banks, capital from service provider but also possible funding, play an important role. A well planned broadband network is amortized in a given number of years and the profitability gap is smaller the longer a network can be maintained at the same conditions. The following points could be of help:

Conduct market exploration studies

It is first of all necessary, especially in the starting phase of a broadband project, to get an overview of the technical and economic possibilities of broadband

provision as well as the estimated cost of investment. It is advisable to always use a market exploration procedure to obtain non-obliging offers from national service providers

Boldness to find joint solutions

If communes get no or inadequate offers for the provision for a settlement area in question, they should work out possible solution scenarios with potential service providers in talks. Whether or not a co-operation of many service providers or a public private partnership (PPP) is relevant should be discussed extensively and weighed against the costs and the long term benefits for the citizens.

Sound out financing possibilities

If all available offers have profitability gaps then economic profitability must be weighed against technological perspectives (short term solutions or long term investments). As soon as the financial framework of a project is laid, the project consortium should approach local and trans-regional participants in order to acquire large customers for the new connections to be established and by doing so improve the profitability of the network. Banks and credit institutions should be immediate points of contact in order to secure financing. A joint investment fund, possibly with financial participation of citizens is an opportunity. In addition initiatives such as provision of property or personal structural contributions could reduce the total project cost significantly.

Profitability analysis

There can be no rule of thumb calculation of broadband projects. There are too many individual factors that play a role. Every service provider has their own experience in terms of offer and used technology. An important factor for example is the number of new customers an internet provider acquires through access of a region.

Analyzing need (compare with recommendations for administrative approach) is as helpful as bundling demand by considering firms, public facilities and private households into the total calculation. With the help of these mixed calculations, the overall evaluation is stronger for the internet service provider and the necessary mass of required customers is easily achieved. The point in time from when on an internet network works profitably and the necessary investment is refinanced is important. Depreciation periods can differ greatly depending on technology and service provider

Open markets

Opening the established infrastructure to the market is basically to be recommended, because this often improves the profitability of a broadband network. Here too, the higher the utilization of an infrastructure the more it pays off to invest. By opening to the market, a service provider who physically provides the connections gets remuneration from service providers that use the connection to deliver services. It is often a prerequisite for granting of funds or communal subsidy to have a connection open to the market.

Reducing cost of planning and connection through own initiative

A strong commitment, whether from administration, citizens, politics or other participants is essential for success of the project and helps in most cases to reduce the profitability gaps. In many communes, citizen initiatives give important impulses, inform neighbours and actively help in planning the project. In implementation of cable linked solutions, the connection costs can be reduced by digging

own property connections. In some cases it is enough to offer the roof of one's property for a radio signal distributor or help neighbours and friends install hardware devices. For this, a good information and communication strategy is indispensable (compare recommendations for administrative approach). Involving the regional chambers of industry and commerce and local workshops can quickly mobilize expertise and strong support for planning and implementation.

Financing strategies

It is often difficult for local initiators of broadband projects and for citizens and later users of a broadband connection to adequately assess the financial framework of a broadband project. A transparent approach by the service provider is therefore important to create confidence in citizens. Especially developing a shared understanding of the amortization period of investment costs, what conditions (e.g. number of new customers) should be achieved and how to deal with areas that are difficult to finance.

Contractual regulations with customers

Customers have expectations concerning the offered price models and flexibility when dealing with price lists. Special aspects are the possibility of changing price rates (larger or smaller bandwidth, additional booking of flat rates etc.) and the notice period at contract termination. Usually the duration of contracts is up to 2 years for one broadband access, not lastly to offer small service providers with a level of security for planning. Citizens would like a lot of flexibility. Which is, why one can make use of special contract termination rights (especially for long contract durations) which is a good solution for both sides.

5.3 Technological approach

The results of this research clearly show that neutrality of technology is essential to contribute to success. The individual economic and topographical framework can influence the use of certain technologies but do not rule them out before a detailed analysis. It is therefore recommended to test all available technical options without bias.

Against all existing reservations, the use of a technology does not rule out the implementation of another solution. The construction of a radio network does not stand in the way of construction of a glass fibre linked network. Possibly a radio network could finance an optical fiber network in the future or only both options in combination are profitable or feasible. In the foreground or the technical implementation stands the economic sustainability to maintain the broadband connections at affordable prices in the needed quality.

Optical fibre networks

The goal is to employ a blanket coverage of networks with large bandwidth all over Europe. The federal government has already initiated the first steps with its` IT-strategy. The European commission is currently developing ideas, how NGA can be employed in Europe and under what conditions a faster broadband expansion can be supported. The possibility of multi-usage plays an essential role here. With the „multiple fibre"-architecture in optical fibre networks, many service providers can create broadband internet connections independent of each other, which would guarantee long term and sustainable competition. The decisi-

on on how far an optical fiber network can be expanded is incumbent on the service provider as the owner of the network.

Radio solutions

Radio linked technologies have been for years an alternative connection of under-serviced or under-serviced regions for market leaders also. Radio linked technologies are on one hand designed for mobile (nomadic) use and on the other hand as permanently installed infrastructure. That is why certain radio technologies such as UMTS (mobile telephones) or WLAN (frequency 2.4 GHz for notebooks) should be readily accessible to enable provision for many users in a given radius. Other radio linked technologies such as directional radio or WLAN (5.4 GHz) are designed to transmit large bandwidth over long distances with permanently installed sender and receiver facilities. Directional radio distances are used as the backbone of mobile radio masts.

An essential difference as compared to cable linked technologies is the shorter construction period and the lower cost of investment necessary for the installation of radio linked solutions. In this case a radio linked technology for example can be used as a backbone. An additional advantage of radio lined solutions is the demand oriented expansion as opposed to cable linked solutions whereby only households with a contract can be accessed.
Since there are many different radio linked technologies, there are also just as many biases and misunderstandings and unclear use of language, it is necessary to increase enlightenment efforts when a radio linked solution is to be implemented. Radio linked networks are sometimes built to be used in a later evaluation and collected revenue used to supplement or replace with glass fiber networks.

Plan network infrastructure

Independent of whether radio or cable linked network solution are implemented, broadband networks are being expanded and are developing. An inquiry on expansion plans of telecommunication companies and also of large businesses and the public sector in the coming years can be integrated in a market analysis (as in economic recommendations).
A basic part of high potential network infrastructure is the homogeneity of the implemented solutions. It should be a target to use the same technology in large areas. This does not rule out a mix of technologies. When many technologies are in use in a network, it is important to define the interfaces clearly. If this is an interface between two service providers, then the responsibilities and access rights should be clearly stipulated. The technical conditions of cooperation are defined by the federal network agency.

Empty conduits as a strategic measure

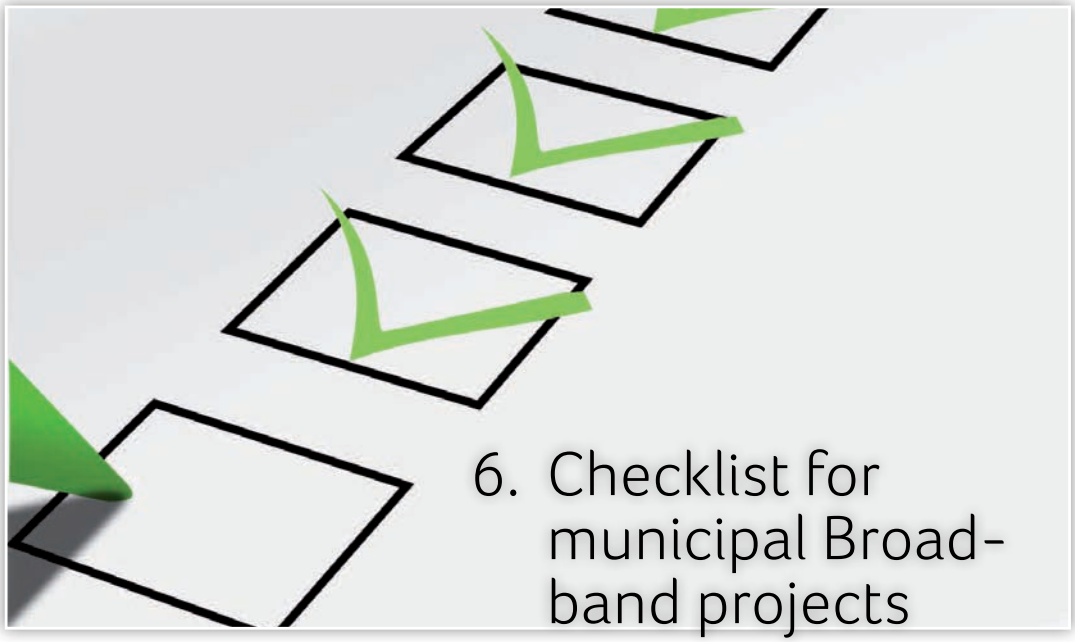
Laying empty conduits during construction works is in some regions to the strategic acts for the future of establishment of optical fibre cables. Civil engineering is the main cost factor when implementing cable linked broadband technologies. That is what makes it recommendable to verify the laying of empty conduits which are then made available to many service providers, while civil engineering works are underway. Some support programmes have a suitable laid down standard.

Scalability

Not only the download and upload rates are relevant in the evaluation of the technology used in development. The future reliability in the form of scalability of the bandwidth plays an important role. The current and medium-term demand generation of the target groups should be considered. The uploa drates are relevant

for most firms because they tend to send large data packages and have their own internet offers. It is important to define a „real minimum bandwidth“ and guarantee that a service provider can provide all customers with this. Beside the data transmission speed, from a technical perspective, the latency (time data requires to get to the receiver) is important for real-time users. Networks with high latency lead to delays in transmission and make pauses in conversations or video conferences unavoidable. The manufacturer of software for special applications have framework data on this.

The recommendations for action depicted in this study from the areas administrative approach, economic perspective and technological approach give an insight on the complexity of the topic broadband expansion. They should not and cannot be taken dogmatically and are not a book of rules, but give hints of what issues can be broached within an expansion project. To provide solid assistance in the development and realization of broadband projects, a sort of manual in form of a checklist has been developed that makes the essential aspects of realization clear.



6. Checklist for municipal Broadband projects

For the planning and implementation of a broadband project a structured approach is preferable.

In the following checklist recommendation and advises for the different project phases are given.

1. First Step

1.1	Set up a clear information- and communication-structure in the commune.	☐
1.1.1	Name one or more responsible persons with a sufficient contingent of time.	☐
1.1.2	Create a plan of action, which includes short-, mid- and long-term planning, as well as temporary actions (analysis of needs) and continuous tasks (infrastructure atlas).	☐
1.1.3	Use external experts (e.g. committed citizens, consults) if needed.	☐
1.2	Conduct a market exploration study, by asking all relevant telecommunication providers for non-binding offers.	☐

2. Regional analysis of demand

- 2.1 Create a questionnaire, which collects the status quo of the demand and the overall supply rate. ☐
  - 2.1.1 Explain in the beginning the aim and the importance of the analysis of demand. ☐
  - 2.1.2 Consult data protection officer and verify the use of geo-referred data which is possible. ☐
  - 2.1.3 During the conception take into account the different requirements of private households and companies. ☐
  - 2.1.4 Ask for the willingness to pay for the speed, which is wished. ☐
- 2.2 Check for the demand analysis the requirements and possibilities in the respective aid program. ☐
- 2.3 Arrange the distribution of the questionnaire on the most possible ways of communication (official journal, local newspapers, internet forms, and individual letters). ☐
- 2.4 Speak with local multipliers (e.g. schools, societies, trade and repair businesses) and link them to the planning. ☐
- 2.5 Check the number of returning and filled out questionnaires. A return rate of at least ten percent should exist. ☐
- 2.6 Evaluate the results. Focus should be given on evaluation of the already existing supply rate, the demand of broadband access per household, the expectations of internet speed and the willingness to pay. ☐
- 2.7 If possible, transfer the results of the analysis to a geo-information system, to make future planning easier. ☐
- 2.8 Compare the results of the analysis of demands (spot tests) with the availability checks of telecommunication providers on their respective website. ☐

3. Establishment of the framework requirements

- 3.1 Start with an interest determination procedure to collect binding offers, if the market exploration study did not provide cost-covering offers. ☐
- 3.2 Assign a feasibility study, with the aim of concrete recommendations for the use of the different technologies. ☐
  - 3.2.1 Explore the technical possibilities taking into account the topographical and demographical preconditions. ☐
  - 3.2.2 Clarify the existence of already installed infrastructure and its potential for future use (e.g. possible places for antenna, existing fibre or TV-cables). ☐
  - 3.2.3 Gather data about the infrastructural recourses of telecommunication providers, but also train and transport companies. ☐
  - 3.2.4 Based on these examinations all data shall be implemented into an infrastructure atlas, which should provide information of all existing infrastructure and every relevant plan of construction. ☐
- 3.3 Check the financial possibilities, taking into account the results of the studies and the returning offers. ☐
  - 3.3.1 Calculate which financial share has to be financed by whom. ☐
  - 3.3.2 Keep an eye on the development of prices and compare direct costs with additional offers. ☐
  - 3.3.3 Ask for measurements which may reduce costs (e.g. use of existing infrastructure, internal labour, rented cables). ☐
  - 3.3.4 Speak to possible partners, who might want to partly finance the project. ☐
  - 3.3.5 Calculate the existing operating expenses of a planned infrastructure including the continuous earning situation. ☐

4. Development of a regional aim

- 4.1 Set up a regular exchange on actual and future planning and topics on a regional level. ☐
  - 4.1.1 Consider together how the future cooperation could look like to create economical and sustainable solutions. ☐
  - 4.1.2 Adjust planned construction works to the greatest part possible. For example, by regular adjustment of the respective infrastructural atlases. ☐
  - 4.1.3 Use regular round table discussions and work groups to coordinate the long-term development of the planned constructions. ☐
- 4.2 Maintain regular contact to the telecommunication provider. Keep a close focus on a clear communication and discuss project planning in detail. ☐
- 4.3 If required, set clear priorities for the order of single development projects. This may be required under the circumstances of different supply precognitions and/or financial bottlenecks. ☐

5. Project development and planning

- 5.1 Before taking a decision, use the possibility to talk to the citizens during information events and in face to face discussions. Valuable impulses might come from these. ☐
- 5.2 Choose an open market model for the network. This creates new possibilities of competitiveness. ☐
- 5.3 Plan the installation and the development of the supply net together with providers, experts and citizens. ☐
  - 5.3.1 Compile the technical planning of the project based on the result of the feasibility study and additional consolidated findings. ☐
  - 5.3.2 Define a detailed time schedule, fixing the responsibilities and the single work steps in it. ☐
  - 5.3.3 Install a long-term cost planning, regarding different scenarios of earnings. ☐
  - 5.3.4 Exchange with all involved actors on a regular basis on the current status of planning and future steps. ☐
  - 5.3.5 Check if and in what form single calls for tenders are required. ☐
- 5.4 Assign the first technical crews for preparation works. ☐

6. Development of Broadband infrastructure

- 6.1 Accompany the phase of installment and development. Especially with bigger projects, pay attention to a good coordination of the individual responsible persons. ☐
  - 6.1.1 Coordination of the important developments steps should be done by you with the highest accuracy, to deeply influence the future steps of the project. ☐
  - 6.1.2 During the installation and development process keep constant contact to the executing provider and supplier and all otherwise involved auteurs. A good exchange on all levels is required if possible planning anomalies occur. ☐
  - 6.1.3 Adjust and update the time schedule, especially in the case of delays, which would prolong the project runtime. ☐
  - 6.1.4 Check, if the cost calculation relates to the actual expenditure and if applicable set up additional measurements. ☐
- 6.2 During the phase of construction and installation document all results and experiences. ☐
- 6.3 Inform the affected citizens and local media after finalization of bigger single development projects and access connection. ☐

7. Evaluation and amendment

7.1 Make sure about the carrying out of the concrete construction work. If applicable arrange a final acceptance of the construction work. ☐

7.1.1 Note specifics that occurred due to the unforeseeable area related conditions or other unplanned events. ☐

7.1.2 Review the findings from the project process with the involved auteurs, especially if additional construction steps or projects are planned. ☐

7.2 Set additional dates for information events and direct discussions with citizens after finishing the development project to exchange the experiences made during the time. ☐

7.3 Collect all results in a project documentation. Make sure to arrange them in chronological order and by including all single steps. ☐

7.3.1 Note short-term and constant developments in the project documentation (for example new developments of costs or competitions). ☐

7.3.2 Update the network planning. By using a geo-information system additional future development projects can be mapped. ☐

7.4 Follow a strategic approach for the future development of the net. Set up a regular exchange with neighbor municipalities and communes. ☐