

LOCAL ACTORS BUILD BROADBAND INFRASTRUCTURE

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Abstract

This paper explores how local actors can play a role in bridging the rural broadband divide. It presents the bottom-up development of broadband infrastructure in the rural region of 'Sogn & Fjordane', Norway. To bridge the broadband divide individuals, businesses and public sector in several rural communities have joined forces and have taken an initiative to develop and operate local broadband infrastructure. Each initiative faces a different set of challenges depending on the local context. The paper opens up the 'black box' of the innovative process to get a better understanding of the alternative process needed to develop broadband infrastructure in rural settings when the market forces do not apply. Two initiatives will be used to illustrate how the communities have assembled rural broadband access using available knowledge and relational resources and infrastructure to achieve the goal, which is contrary to the traditional roll out of telecom infrastructure.

Keywords: infrastructure, broadband, regional development

1 INTRODUCTION

The use of information and communication technology (ICT) is changing the way we are organising society. Provision of services such as e-government, e-learning, e-health, and to enable a more dynamic e-business environment (eEurope 2002) are important to facilitate regional economic development. To be able to reap the benefit of these services it is necessary to have sufficient access to communication infrastructure that is to broadband infrastructure.

At the time of market liberalisation of the telecom sector, the Norwegian government chose a demand driven strategy for development and delivery of broadband internet access. The competition among telecommunication providers was believed to be sufficient to ensure provision of broadband services to everyone. A study carried out in the county of 'Møre & Romsdal' (Molka-Danielsen et al 2003) found that there are clear differences between rural and urban areas in 'Møre og Romsdal' with regard to the development of broadband infrastructure. 'The aggregation of demand of users in rural communities is often not great enough to justify the investments.' (ibid)

The government have put in place mechanisms that can increase the demand, particularly in rural areas; they are supporting regional and local governments by partially funding the acquisition of broadband services. This is a welcome contribution, but the local and regional government still have to provide the major part of the investment, which can be difficult. When the local and regional government are providing services requiring broadband capacity it is also necessary that inhabitants and businesses have equal access to be able to utilize these services.

Having access to broadband infrastructure is one way of making the conditions for enterprises in rural and urban areas more equal; the same kind of infrastructure at the same cost. It is important to ensure that both the public and private sector have access to ensure a living community. The national strategy encouraged local and regional governments to systematically work together with local businesses to aggregate a demand and share the cost for broadband access.

'Sogn & Fjordane' is a rural region very similar to 'Møre & Romsdal'. At the time of the teleliberalisation in 1998 very few organisations had access to high-speed communication; the cost was too high to be cost beneficial. In an effort to get broadband access and to be able to compete with more central areas when it comes to establishment of new businesses and public services, a number of local initiatives have been taken to bridge the broadband divide. This strategy has been successful and today only eight of the 26 municipalities have less than 50% coverage (Hagen 2004). Of these only one has less than 25% coverage (ibid).

This paper analyses two instances of how the local actors are bridging the rural broadband divide. It presents an alternative to the traditional roll-out of telecom infrastructure, a bottom-up development of broadband infrastructure in the rural region of 'Sogn & Fjordane'. To bridge the broadband divide individuals, businesses and public sector in several rural communities have joined forces and taken the initiative to develop and operate local broadband infrastructure. Each initiative faces a different set of challenges depending on the local context. The paper open up the 'black box' of the cultivation process needed to provide broadband access in rural areas. Two initiatives will be used to illustrating how the communities have cultivated rural broadband assess using available knowledge relational resources and infrastructure. By doing so they have aggregated a sufficient demand for broadband to support the investments needed.

2 RELATED RESEARCH

This paper will use theoretical contributions from the literature on regional innovation systems. This literature can help in understanding the processes of building telecom infrastructure in rural area. In

addition concepts from actor network theory is used to explore the development process, they are part of the larger framework of analysis needed to understand the process.

Local communities are currently facing challenges both from within their community and from a global perspective. As a result of technological development a local community is today much more than before influenced and challenged by things happening in a global perspective. How inhabitants, companies, and organisations react to these challenges and how they co-operate and compete will to a great extent influence their capacity to develop efficient responses to challenges (Amdam 2000; Healey et al 1999; Putnam 1993; Stöhr 1990). A community's capability of facing challenges is particularly dependent on how the various actors or stakeholders manage to produce and exploit competitive knowledge (Diez 2000). At the same time, challenges must be countered through strategies and tasks that the whole community is involved in and which are adapted to suit the actual situation and challenges of the community in question (Stöhr 1990).

The linear innovation and diffusion model that dominated for a long time is now widely accepted as being too simplistic to explain all situations (Rogers 2001). Further it has revealed that such processes are influenced by a number of factors, both at a micro and more aggregate levels. The term regional innovation system has thus been introduced to explain part of this complexity. Evolutionary research in the fields of regional economics (Morgan 1997) has defined the main characteristics of regional innovation systems as being learning and innovation, with both individual and collective innovations. Collective innovations are seen as interactive processes in which the firms' networks are important aspects of their collective innovative capability. This term captures the trend of building regional organisations and networks to strengthen the innovation capability of enterprises (Cooke 1998). It also includes collaboration on innovative activities (knowledge development and diffusion) between enterprises and knowledge organisations such as research institutes, colleges, libraries, consulting companies etc in the region (Asheim et al 1997). Results from studies show that the innovative capability of enterprises is highly dependent on their ability to come into contact and to co-operate with other actors, such as customers, suppliers and R&D organisations (Gregersen et al 1997).

The regional innovation system encompasses Latour (1987) two contradicting models; 'model of translation' and 'model of diffusion'. The 'model of translation' describes the innovative processes leading up to a stable product or fact. That is the actions needed to enlist and interest human and non-human actors in the development of an artefact. When these actions are being successful then there is no way around the implementation and diffusion of the artefact. The 'model of diffusion' then describes the actions and strategies needed to diffuse the artefact. In this diffusion process the technical artefacts are equipped with an inertia that moves or diffuses the artefact in a way that seems independent of human action.

In the translation process access to local resources is vital for the innovations taking place in a community. The most cited resources are; intellectual, social, cultural and institutional capital (Putnam 1993; Bourdieu 2001; Healey et al 1999). Social capital refers to the social relations and duties that the individuals in a society have toward each other. It takes time to develop this kind of capital, but it can later be taken out as surplus to gain personal or collective goals in a translation process. Healey et al (1999) uses the expression 'institutional capital' to refer to a combination of the knowledge resources, relational resources and mobilisation capability in a community. Access to knowledge and relational resources are a prerequisite for mobilisation or to be able to develop a sustainable institutional capital. The knowledge resources are broadly defined as both active and tacit knowledge and the ability to absorb new ideas. While the relational resources refer to the fact that every individual take part in different social networks with different form and reach it also refers to the activity of enlisting and interesting actors and keeping them interested. To achieve common social goals, these resources have to be deliberately mobilised through use of common arenas and networks using mobilisation techniques and change agents (Healey et al 1999; Amdam et al 1998).

The relational resource as described above includes social and cultural networks that connect individuals, social groups and different types of knowledge. In the networks ideas and impulses are

communicated, just like the densely coupled nerve system of a community. What connect such networks are common interests and relations. Törnqvist (1997:102-103) shows that accumulation and development of knowledge in the networks happen through personal contact and communication. According to Healey et al (1999) these knowledge and relational resources must be deliberately mobilised in the development of a community.

Healey (1997) points out that to develop a community there is a need to create alliances across special interest groups and ethnical divides to be able to face the challenge together. When there are established arenas where inhabitants meet and discuss, they can learn from each other. The common platform which may emerge through this collaboration can be a basis for the mobilisation process needed to meet future external challenges. By operating in this way the inhabitants and businesses are better equipped to transform the external challenges to their community's advantage. The aim of this paper is to explore such processes relating to infrastructure development.

The paper explores the process of establishing heterogeneous networks consisting of both a technical and organisational actors. The aim is to understand the process; 'how' and 'why' (Yin 1994) things happened. An interpretative research approach is used to get a better understand the unfolding of the development. Interpretive research is concerned with the development of a deep and contextual understanding of the phenomenon. The focus is on the subjective processes surrounding the social construction of the network, using qualitative research methods (Walsham 1993). The aim of such interpretive analysis is to understand rather than to predict. The interpretive perspective helps to focus on the formal and informal parts of the process that took place.

This paper reports from a longitudinal process, which covers the years from 1998 – till today, which involve activities at different levels; at both regional and local levels. One of the authors of the paper has been actively involved in the process either in person or through the organisation she represent. In this process the author have not tried to stay distanced or remain a silent observer, but on the contrary having been participating in the group activities at the regional level. The involvement have been as a participant observer (Cole 1991; Baskerville et al 1996) attending meetings and conferences discussing broadband development in a period from 2000 till today, the degree of involvement have varied over time as the issues have varied. In addition to attendance the author have had access to minutes and to the discussions taking place. Data has been gathered as part of this process. Also in relation to the level data have been gathered as part of the regional process covering the interaction between the local and regional level. In addition the author have been following the development using the websites describing the local offers and supplemented with dialog with key actors in the developments. To supplement the picture two free form interviews was carried out interviews with the main actor in each of the local initiatives.

To explore the initiatives in dynamic and historical perspective (Granovetter et al 1998 p. 149) concepts from actor network theory (Latour 1987; Monteiro et al 1995; Callon 1999). The creation of an actor-network involves linking a number of heterogeneous 'things' (Monteiro 1999) through the enrolment of actors and the translation of their interests and ideas into the network and thereby aligning them (Callon 1999, Walsham 1997). The length of the paper have not allowed for detailed descriptions of the initiatives. For this reason the use of ANT concepts is not explicit in the descriptions but in the underlying analysis they have been important for understanding and describing the development of the network and the roles and relationships of the actors.

This approach opens up for a degree of uncertainty as the events are interpreted and the interpreter bases their interpretation on the knowledge they have about the development, this again can open up for different interpretations. In this case, the interpretation is carried out as a critical reflection by one of the actors in the network. The aim is to analyse the development of the network exploring the development process. In doing so, it enables the researcher to get a detailed understanding of the development process, given the specific context.

3 BROADBAND DEVELOPMENT IN THE ‘SOGN & FJORDANE’ REGION

The ‘Sogn & Fjordane’ region is located in the western part of Norway, covering an area of 18,634 square km and with a population of approximately 110 000 inhabitants, that is an average of about 6 persons per square kilometre. The region is characterised by a harsh nature with glaciers, mountains and fjords dividing the populated areas.

The inhabitants are spread over large parts of the region with a few agglomerated areas. The industries are to a large extent based on natural resources and are therefore located close to a source for one of its input factors. The main industries include fish farming, fishing, agriculture, food industries, shipyards, mechanical industries, foundry and metal industries, hydro power/energy and tourism. The region has the largest export per capita in Norway (4.6 % of the total export from Norway). Together this makes the region very challenging to develop and in particular with regard to broadband infrastructure. For commercial providers the cost of cabling the whole region is too high and the demand is too small (Grubestic 2003, Grubestic et al 2002).

At the time of tele-liberalisation in Norway in 1998, access to broadband infrastructure was limited. In the ‘Sogn & Fjordane’ region broadband access was very limited, the regional college and research institution along with the regional hospital had access to broadband capacity while some enterprises had access to leased lines for specific purposes and used ISDN for email and internet access. At the same time urban areas were offered a number of broadband alternatives from both local and national providers. The national providers had no immediate plans to develop broadband access to these areas.

To meet the challenge a number of regional and local initiatives have been taken, utilizing existing relational and organisational network and establishing new where needed. A total of 10 local initiatives are ensuring that large areas of the region now have access to broadband infrastructure. Below is a list of the initiatives with a short description of main characteristics (BBF 2004).

Initiative	BB since	Owners/ involvement	Infrastructure	Users/Use	Operation	Coverage
Aurland & Lærdal breiband AS	2003	Ltd owned by 2 Municipality + 2 el. suppliers	existing cable-TV + ADSL + wireless	Private and businesses	Internal operation	Aurland most developed
Datapart AS	2002	Ltd privately owned	Wireless + ADSL	Private and businesses	Internal operation	Luster & Sogndal
Eninvest AS	2000	Ltd owned by 4 municipalities and 3 el. suppliers	ADSL + Wireless	Private and businesses	Internal operation	Nine municipalities
Firdanett AS	1999	Ltd company owned 1 el. supplier	ADSL + Wireless	Private and businesses	Internal operation	Gloppen
Jølster Breiband AS	2002	Ltd privately owned	wireless	Private and businesses	Internal operation	Mainly Jølster
Kapasitetslaget AS	2000	Ltd Public private partnership	Fiber	Businesses & public sector	No employees use the network	Sogndal, Leikanger, Luster
ViaVest AS	2000	Ltd joint venture between companies	wireless + leased lines	Businesses	Internal operation	Stryn
Vik IT-Partnar AS	2002	Ltd privately owned	wireless	Private and businesses	Internal operation	Vik Balestrand in coop. w el. supplier
Zet.no AS	1998	Ltd privately owned	Wireless + fiber	Private and businesses	Internal operation	5 towns
Årdalsnett AS	2001	Ltd 12 local owners	existing cable-TV + wireless	Private & businesses	Internal operation	Årdal & Lærdal

Table 1. Overview of broadband initiatives in the region Sogn & Fjordane as of March 2004.

All these initiatives cover each only a part of the region 'Sogn & Fjordane' and all are the result of local initiatives.

In addition to the local levels there is a regional initiative called Broadband-forum 'Sogn & Fjordane'¹ (BBF); a network organisation, initiated in 2001, in response to the increasing interest and need for broadband infrastructure in the region. BBF is a task force that places focus on establishment, development and utilization of broadband infrastructure in local communities. BBF initiated and participated in a number of activities, such as; information meetings and an annual conference, surveying the availability of broadband infrastructure, and participated in a number of externally funded broadband projects focusing on the utilisation of the network for provision of services or education. The national broadband plan says that infrastructure development must be based on market forces. By ensuring the information flow and exchange of experience the forum is supporting the demand side and there through strengthening the demand for broadband service, the aim is to have a competitive market in most parts of the region.

The following will focus on two of the local initiatives to in an attempt to look at the factors contributing to the development of the infrastructure.

3.1 KAPASITETSLAGET² – SOGNDAL MUNICIPALITY

Sogndal is one of the main agglomerations in the region. The municipality has about 6,600 residents and an additional 2,000 students during the school year. Sogndal has a diverse business structure. Agriculture is important, and so are the manufacturers who use local raw materials in their products, such as 'Lerum Conserves', which turns fruit and berries into preserves. The community has one of the largest upper secondary schools in the country and is home to the 'Sogn & Fjordane' College and the Western Norway Research Institute.

'Sogn & Fjordane' College is located in many buildings spread throughout Sogndal; a broadband infrastructure between these buildings has been built over the last 10 years. This infrastructure consisted of leased lines from the national telecom provider Telenor, and lines owned by the college itself and the municipality. When tele-liberalisation occurred in 1998 this infrastructure was purchased by the college and the municipality.

In the period from 1996 to date the two largest public organisations in the region have participated in several European research and development projects together with the local research institute and college. The focuses of these projects were on a number of issues related to diffusion of ICT to local businesses and use of ICT to improve delivery of public services – eGovernment services. In this process they got in touch with several small local technology companies. In 2000 the need for a better, faster infrastructure became apparent both to be able to provide services to the wider user community of businesses and inhabitants and for interaction with the technology sub-suppliers. For the individual organisation the cost-benefit was too high, but as an integrated group they saw that there could be an opportunity to obtain broadband access at less expensive rates. The two regional public sector organisations³ applied for public funding through a national program (HØYKOM⁴) and managed to secure the initial funds for the initiative, testing out delivery of public services and on connection to providers of tools and services.

Toward the end of the project the joint venture company 'Kapasitetslaget i Sogn AS' (KL) was established, to continue the work. Twelve private companies joined efforts with the local energy company 'Sognekraft', the college, the research institute, and regional public sector organisations in

¹ <http://www.it-forum.no/pub/menu/mid9-40.asp>

² <http://www.kapasitetslaget.no/>

³ The Sogn og Fjordane County Municipality and the Sogn og Fjordane County Governors office

⁴ <http://www.hoykom.no>

this effort. The new company's main purpose was to negotiate inexpensive internet access and to stimulate the building of regional and local broadband infrastructure. They aim at coordinating the development of the ICT-infrastructure, and negotiating common internet access for all partners. The common infrastructure improves the communication between companies and offers a platform for collaboration and joint efforts among the small enterprises.

The broadband network was extended to two neighbouring municipalities Leikanger and Luster in 2002 and presently more than 30 companies receive broadband internet access through KL. The 20 km line to Leikanger from Sogndal is rented un-terminated fibre lines (dark fibre). A new 30 km power and fibre line has been installed to connect Luster, and two local energy companies are renting out un-terminated fibre to KL. In summer 2003 a new piece of infrastructure was installed to connect the village Kaupanger, and this about 20 km long line is owned by a local power company. One spin-off activity is the national portal norge.no which was located in the area because sufficient broadband capacity was available, in addition to the availability of skilled workers and the low cost of office space. Several new ICT intensive companies have been able to locate in the area due to the network capacity.

KL negotiates access to the national infrastructure at regular intervals. In negotiating they achieve sufficient access at all times at an acceptable cost, dependent on the needs of the customers. The experience is so far that working jointly in this way has led to cheaper and faster access for all the companies connected through KL.

3.2 FIRDANETT⁵ – GLOPPEN MUNICIPALITY

Gloppen is one of 26 municipalities in the region; it has a population of 6000. The modern history of Gloppen is one of decline. In the past employment was in the agricultural sector and in the textile industry. The textile industry has been closed down. Farming is still an important industry (Statistisk Sentralbyrå 2002), but currently it is the public sector that employs the most people. The development of the local broadband initiative Firdanett is the result of several interacting processes.

In 1996 the chamber of commerce was revitalised and a new strategy was published with the aim of changing the development of the community (Gloppen Næringsorganisasjon 2001). This strategy included a reorganisation of the chamber of commerce, employing a full-time manager, and a process leading to a joint understanding of the current status and of the future challenges. As a part of this new strategy the chamber of commerce initiated co-operation with the municipality. This was welcomed by the local politicians, who also looked for new opportunities for developing the municipality.

A Gloppen based ICT firm, 'Datainstituttet as', had several customers who wanted to buy additional ICT services such as backup, printing and server space. Several of these customers were located in the same building as Datainstituttet, and to these customers the services were made available through a Local Area Network (LAN) established in 1996. Due to regulations in the law, it was not possible to expand the LAN to other surrounding buildings. When the tele-liberalisation took place in 1998 the laws were changed and the LAN was expanded to other customers outside the building. This LAN and its services formed the basis for the development of the broadband network.

To be able to improve the handling of the investments needed to develop the infrastructure, a new company, 'Gloppen IT nett' was established. 'Gloppen IT nett' was a collaborative effort between Datainstituttet, the chamber of commerce, the municipality, and the local energy company (Gloppen kommune 2000), and was equally owned by the partners. The company continued to develop the LAN into a full broadband network. In collaboration with the municipality they secured public funding through a national program (HØYKOM) to be able to develop the network to include all public offices. The project was important to expand the network to get better coverage throughout the

⁵ www.firdanett.no

municipality. The development of 'Gloppen IT nett' is considered an exemplary model (Samferdsledepartementet 2002) for public-private partnership when it comes to development of broadband infrastructure.

The operation of the 'Gloppen IT nett' was handled by Datainstituttet. After about a year, the owners could not agree on a joint financial and strategic plan for the company. Datainstituttet sold their shares to the regional energy company. 'Gloppen IT nett' was refinanced and its name was changed to Firdanett. Firdanett is mainly owned by the local energy company with the chamber of commerce and the municipality as minority shareholders. Firdanett has two employees, one technician and one salesman. In March 2004 Firdanett merged with another broadband company Eninvest. Eninvest is in part owned by the same energy company; the effect of this merger is not yet clear and will not be further addressed in this paper.

Firdanett offers broadband internet access and IP telephony, and Datainstituttet offers their ICT services to the businesses connected to the network along with other service providers such as accounting. The local broadband infrastructure consists of a mix between fibre technology and radio transmitters / receivers. Firdanett has access to national infrastructure through a 6 Mb connection through the national provider Telenor.

As a result of this local initiative, 55 companies and 85 households receive broadband internet access [2003 figures]; despite the absence of the national provider Telenor, which at that time did not offer broadband to the households and the small businesses in the community. Co-operation between the public and the private sector, with the private sector as initiator, is characteristic for Gloppen (Gloppen kommune 2000). Some spin-off activities are the Sandane Business Garden, which is offering an innovative environment for knowledge based firms and incubator facilities for start-ups. The establishment of a call centre with initially 40 jobs (it has been downscaled quite a bit recently), and a company providing internet based services related to digital images, Eurofoto, with eight new jobs are direct results of the broadband initiative in Gloppen.

4 DISCUSSION

The following section will discuss the two initiatives in relation to the theoretical background to get a better understanding of the factors contributing to the development of broadband access in rural communities.

4.1 THE DEVELOPMENT OF KAPASITETSLAGET

The initiators of KL had a common problem; they needed high capacity access to the internet to provide services at regional, national or international level. These services were generating heavy traffic both in the form of large files and the number of requests, e.g. norge.no, which has approximately 30,000 hits on its website every day. The common problem between the initiators made it easy to align the actors, it was also obvious that other actors in the location had similar problems this made it easy to recruit new participants and align them and their interests into the network. In the alignment process it was discussed whether the new organisation KL should deliver additional services, as a result KLs business area was defined as being negotiation of inexpensive broadband access while delivery of services was defined as being outside; the aim was to keep it simple to ensure the support of as many actors as possible.

Actors were enrolled for a number of reasons, the main being expressed interest and need, access to knowledge and infrastructure. The actors represented private companies, public sector, third level institutions and research, having this combination was important to strengthening the innovative capabilities (Cooke 1998) and the ability to succeed with the development. The enrolments of these actors have also made it possible to build on the installed base in the community both with regard to access to knowledge resources and infrastructure.

Across the organisations taking the initiative, there was access to the knowledge and skills (Healey et al 1999) needed to plan and establish the infrastructure. Together these actors had the knowledge and relational resources (Healey et al 1999) necessary to move forward and they were able to mobilise and realise the plans, by finding ways of funding parts of the development through a project funded by the HØYKOM program.

With the enrolment of the owners of existing infrastructure, KL was able to build on the local installed base because they got access to the existing infrastructure that could be utilized for broadband communication. KL has been able to rent and make use of existing fibre infrastructure; this has been an important foundation for the success. The existing infrastructure that is owned by the municipality and the college was the basis for the development. Both these owners did not see any problems in renting part of the cable to KL for provision of broadband access to other actors. Furthermore the infrastructure that made it possible to connect the municipalities Leikanger and Luster to KL has been built by other actors (the two local energy companies) and KL are renting these lines to provide services to its customers. The collaboration between KL and the local owners of the infrastructure has been a win-win situation. The win-win situation is based on the best possible utilisation of already available fibre infrastructure and the skills and technology needed to connect this infrastructure to the national internet infrastructure. Compared to traditional top down diffusion of infrastructure development this approach may seem 'quick (and dirty)' but was instrumental to keep to cost at a minimum and to be able to provide broadband services as soon as possible.

KL provides the backbone fibre infrastructure to the internet; they do not provide any other services. Provision of other services has been left to the users of the infrastructure. The organisations that want to connect to the infrastructure can do so using radio link in some areas or by connecting to the backbone fibre at their own cost. Furthermore KL does not own the infrastructure but rents it from others, the only work necessary is to operate the switches which in normal situations are not very time consuming. To solve these issues the organisations who jointly own the company have provided a pool of resources and skills so that they can be drawn upon in the operation of the infrastructure. These factors have made it possible to operate the organisation with a minimum of organisational resources and costs. The company does not have any employees, but are renting services from partners in the network and the competence to run the broadband network along with the infrastructure.

The development in of KL did not happen in a vacuum, but in dialog with other parallel initiatives such as Firdanett and other early adapters.

4.2 THE DEVELOPMENT OF FIRDANETT

Prior to the establishment of the broadband network, key actors in the community had joined efforts and agreed on a joint strategy to stop the long-term decline of the municipality. The climate for innovation and change and the trust between the actors was improving. Development of a broadband infrastructure was one of the initiatives taken to achieve this.

The initiative was taken by Datainstituttet who started to build an infrastructure to be able to offer services to their customers in a LAN. The liberalisation of the telecom market opened up for an extended network. Almost the entire infrastructure had to be established from scratch, only the LAN was available as an installed base. They wanted to provide fibre to customers in the centre of Sandane while other parts were connected using wireless access. The cost of putting a fibre infrastructure in place was high and there was no short-term payback from the investment.

Compared to KL they managed to enrol fewer actors in their network, both with regard to knowledge and infrastructure. The support in the community was narrower; the organisations involved had less economic power and represented relatively small organisations without a knowledge base that could be used as a pool in solving problem situations. They needed to have sufficient income to employ the necessary staff; this put a stress on the organisation. Also Firdanett got support through the HØYKOM program which enabled them to initiate the process, an initial pilot-project ensured this.

The ideas and targets of the different owners of Firdanett were not aligned and when the company got into problems this caused organisational stress which led to a reorganisation of the company. Another way of observing this development is that the relational resources and the mobilisation capability was sufficient, Datainstituttet sold their part of the company to the local energy company. As part of this reorganisation they aligned the different interests, separating access from services. The services were transferred back to Datainstituttet who included them in their line of products and services. Now Firdanett is offering competitive broadband internet access and IP telephony as their only services. The number of customers is increasing. In providing services to the community it is important to stress that both KL and Firdanett are successful developments from the communities point of view, while KL have had a much easier development Firdanett have struggled and overcome troubles several times, further it has proven difficult to make money from providing infrastructure.

5 CONCLUSION

This article presented the very successful development of broadband infrastructure in rural communities based on local bottom-up initiatives. Two initiatives were presented in detail. In the two instances different factors have been important for the development, these are summarised in the table below.

	Kapasitetslaget	Firdanett
Strategy	Ad hoc Needs in public sector and business community	Ad hoc Needs in local business community
Actors	Regional public sector Enterprises College & research	Local public sector Enterprises
Prior knowledge	Experience running broadband networks Large organisations with a knowledgebase	General ICT skills Many small organisations with no knowledgebase
Economy	No employees - Human resources 'borrowed' at no or minimum cost Renting infrastructure Not for profit	2 employees Building own infrastructure For profit
Motivation/ alignment	Needs of a few specific organisations Less expensive broadband capacity Well aligned network	Selling services Broadband capacity Developing region At first, network not aligned after restructuring well aligned
Infrastructure / installed base	Based on existing infrastructure	No available infrastructure
1 st adopters	Public sector (number of accesses) + private companies (quantity of data transferred)	Delivery of services between connected enterprises and an Internet based Digital images

Table 2. Important factors contributing to the two developments.

Both these instances are examples of successful developments, they both reached the aim; providing broadband access in their local communities. The purpose of presenting both cases is to illustrate the fact that a market driven establishment of broadband infrastructure in rural areas needs to take local specificities into account, rather than copying the top down approaches used when developing traditional telecom infrastructure. This includes the needs of potential first adopters, exiting infrastructure (installed base) to build upon, local organizations that can take the responsibility of being service provider (network operator), etc.

The successful building of such infrastructures in rural areas requires the pooling of resources (institutional capital) and collaboration in line with Healey's theory. But this case also illustrates that

there are limits to collaboration and pooling of resources when it comes to market driven development of this kind of infrastructure. Closer collaboration between these two initiatives would in this case imply more focus on replication of solutions or focusing on building one uniform standardized infrastructure. This is the way traditional telecom infrastructures are built. Such a strategy would be less focused on coming up with 'quick (and dirty)' solutions where existing infrastructure was utilized as much as possible. It would make it more expensive to build the infrastructure, and it would take more time. This traditional telecom strategy would also necessarily be less focused on satisfying the specific needs of the early adopters as soon as possible. This again implies that it would take more time before customers would actively use the infrastructure and generate income to those building it. Further it implies then that the infrastructure building would require more up front investments, and accordingly makes success more challenging.

It is clear that if there had been no local initiative then it would have taken much longer to get broadband access in these communities. The action taken to speed up the innovation process that is the assembly process is an example of a translation process as described by Latour (1987), in which the artefact 'broadband access' has been patched together and fitted to the local context. By looking at the processes as translation processes we become more aware of the actions needed to build the infrastructure required to bridge the gap between the national infrastructure and the local needs. Most important is that the analysis shows that by taking an initiative it is possible to aggregate sufficient demand. Further that by utilizing local knowledge and infrastructures then the investments are reduced and the development can be justified.

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