Information infrastructure and rural information systems

-A study of the dynamics of local adaptation of ICT

By Ingjerd Skogseid

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Samandrag

Tilgang på og bruk av informasjons- og kommunikasjonsteknologi (IKT) og tilstrekkeleg infrastruktur er viktig for utvikling og levekår både i distrikta og bynære område. Ei viktig utfordring er å sikre ei balansert utvikling som gir like tilhøve alle stader. Målsettinga med dette doktorgradsarbeidet er å kaste lys over utfordringane små samfunn og bygder har med å ta i bruk IKT. Eit viktig spørsmål er kva lokale tilpassingar småsamfunna har gjort for å kunne sikre nødvendig infrastruktur og utnytte IKT for å ta del i den generelle utviklinga i samfunnet.

Utviklinga i småsamfunn og bygder blir påverka av global og nasjonal utvikling. Avhandlinga ser på kva grep småsamfunn kan ta for å møte desse utfordringane. Globale trendar kan gjere småsamfunna marginaliserte fordi marknadsøkonomien har større fokus på kostnaden for å levere tenester enn på verdien av tilgangen. For å oppnå det same som bynære samfunn må småsamfunn i utkantane mobilisere og samordne lokale ressursar som eit mottrekk til den toppstyrte utviklinga.

Doktorgradsarbeidet har analysert tre case som viser korleis kommunar, bedrifter og privatpersonar i distrikta handlar for å møte slike utfordringar. Ein teoretisk informert analyse er gjennomført for å identifisere viktige faktorar for å gjere ei lokal utviklinga mulig. Avhandlinga bidrar teoretisk ved å diskutere konsept frå litteraturen i forhold til eksempla. Avhandlinga identifiserer ei rekkje faktorar som verkar inn på lokaltilpassing. Når nye utfordringar må handterast, vil desse faktorane kunne nyttast i ein metode for å strukturere, analysere og prioritere mulige tiltak.

Avhandlinga konkluderer kunnskap om lokale forhold, om kunnskapsressursar og eksisterande strukturar, gjer at ein kan konsentrere utviklinga og utnytte den eksisterande infrastrukturen der det er mulig og bygge nytt der det er nødvendig. Når lokale aktørar møter globale utfordringar, bør dei utnytte eksisterande kunnskaps- og relasjonsressursar og mobiliseringsevne. Slik kan dei søkje saman lokalt og vere betre stilt i møte med dei eksterne utfordringane.

Andre publikasjonar frå prosjektet

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I also want to thank my family, my mother Oddny Skogseid and my sisters and brothers with family who have always encouraged me to go on. Thank you for always being there and for supporting me!

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Abstract

This thesis is submitted as partial fulfilment of the requirements for the degree Doctor Scientarium at the Faculty of Mathematics and Natural Sciences, University of Oslo, Norway. The work was carried out at Stiftinga Vestlandsforsking (Western Norway Research Institute) in collaboration with the department of Informatics in the research group for Information Systems. Stiftinga Vestlandsforsking and Norges Forskingsråd (project number 132891 & 150249) provided the funding for the work going into the thesis.

The thesis consists of an introductory paper and six published papers. The introductory paper has five sections first an introduction which presents the problem domain and related research. The second section presents the research approach and in the third section presents key theoretical perspectives from the literature. The fourth section presents the research findings from the six published papers. The fifth section discusses the findings in relation to the related research and the theoretical perspectives and concludes the thesis.

This thesis presents an exploratory and interpretative study of the socio-technical change processes that take place as information technology becomes a factor in development of rural areas. Rural areas are facing a number of external challenges, which reflex global change processes. In principle, this development is unbiased regarding the spatial location of users; but ensuring a balanced development between urban and rural areas still poses a challenge. Access to knowledge resources and infrastructure is a prerequisite — and the ability to use them — are needed to achieve this balanced development. Information technology is not the answer to all problems but it is a tool for achieving certain goals. Information technology can be used strategically in strengthening rural regions — actions are needed at policy levels and resources must be made available. Particularly at a local level; local communities have their own responsibility for making sure they utilise the available opportunities. The process of creating such a development and opportunities is no longer just a question of money. It's about utilising the reflexive human capital of co-ordination and conversation. In addition, it is necessary to be capable of co-ordinating and planning actions, to carry them through and learn from them.

The thesis contributes to the research area on development of information infrastructures in a rural context. The thesis aims at giving both an empirical and theoretical contribution to the discussion of information infrastructures and their implementation in rural area. The thesis draws on two rather broad key theoretical perspectives. The first sheds light on the role of networks in contemporary society and in particular in relation to rural communities. The networks are part of the relational resource that enables development through conversation and co-ordination. The second source of literature is concerned with the regional innovation systems. Regional innovation systems are explored to find better ways of supporting socio-technical change processes.

This thesis examines three empirical cases in an effort to increase our understanding of information technology and rural innovation systems. The BookTownNet case has a focus on the network organisation between small rural enterprises and the innovation system relating to development of an Internet infrastructure for communication and collaboration between participants in five rural towns. The second is a comparison between four projects all funded by the European Commission with the aim of supporting learning and better usage of information technology in rural communities. The third case, broadband development in the Sogn & Fjordane region, focuses on innovation systems and information infrastructure development. The following six papers are included:

1) Ingjerd Skogseid and Arild Jansen (2001). *Booktowns on the Internet: Rural Enterprises Enter the Network Society.* In proceedings of the International Conference on Information Systems, New Orleans, Louisiana USA 16.-19. December 2001

2) Jansen, A., & Skogseid, I. (2003). Book towns and the network society: new perspectives on developing rural enterprise. In S. Krishna & S. Madon (Eds.). *The Digital Challenge: Information Technology in the Developing Context*. Ashgate Publishing Ltd.

3) Gripenberg, P., Skogseid, I., Botto, F., Silli, A., & Tuunainen, V. K. (2004). Entering the European Information Society: Four rural development projects. *The Information Society*, 20(1).

4) Skogseid, I. & Strand G. L. (2003) Bottom-up Initiatives' Role in Technological Regional Development. In Riukulehto S. (Ed.) *New Technologies and Regional Development.* University of Helsinki, Seinäjoki

5) Skogseid, I. & Hanseth, O., (2005). Local Actors Build Broadband Infrastructure. In proceeding of the European Conference on Information Systems, Regensburg, DE, 26-28 May 2005

6) Skogseid I. (2007) Improving Broadband Access in Rural Areas. In Handbook of Research in Global Diffusion of Broadband Data Transmission, Dwivedi Y.K., Papazafeiropoulou, A., and Choudrie, J. (Eds). IGI Global, Hershey, PA, USA.

The six papers all draw on the related research and the theoretical perspectives and discuss the cases from different perspectives with the aim of getting a better understanding of the development of rural areas, which face external challenges reflexing global change processes. The technical aspects do not necessarily pose the biggest challenge, rather it is the social aspects surrounding the developments. The strength of the institutional capacity and its use in a community tell something about the reflexivity, that is, how the institutional capacity is used to model forces of change to meet the needs of the community. As part of the process to strengthen institutional capacity, it can be useful for marginalised groups to establish networks to counter an unbalanced spatial development. In this way they can avoid and even contribute to the reduction of the digital divides.

To ensure the sustainability of such development it is necessary to involve the end users in the process. If the user community has been part of the development from initiation, development and operation then the users get a stronger ownership grasp on the product and become more attached to the process. This also ensures a user community with a number of stakeholders who can contribute to secure a critical mass of users. While top-down processes are managed from a central point, the bottom-up process relies on local resources as part of the development, if necessary working together in a network that spans geographical distances.

In a network, one aspect to keep an eye on is the complexity and the kind of couplings that are involved. These reveal something about the vulnerability and resilience of the network. Tightly coupled and interactively complex networks have higher vulnerability; they are more prone to errors and breakdown. A loosely coupled network, which is interactively simple, has far more resilience. A network needs to have the balance between vulnerability and resilience that is acceptable for the actors who use it. When developing information infrastructures, one way of dealing with the complexity is to use a cultivation approach;

creating a self-reinforcing process building on the installed base. Furthermore, simple and inexpensive components can be chosen to extend the installed base — if they break down or fail to meet needs, such components can more easily be replaced by others.

The thesis contributes both theoretical and provides real life implications, related to the development of information infrastructures in rural areas. The concepts derived from the literature and discussed in relation to the cases. These concepts represent important factors contributing to the development of information infrastructure in rural areas, and these factors needs to be taken into consideration in the planning and development of new initiatives. Theoretically the thesis introduces two new concepts to the literature on information infrastructures, institutional capacity and descriptive clusters, both useful in the initiation and the development of infrastructure in a rural setting. The institutional capacity of a community tells something about the community's ability to plan and carry through initiatives, and how they manage to handle external challenges and change forces. The descriptive clusters are a tool to explore the installed base and also to assess and address different aspects of the design and development of the infrastructure as part of the development process.

1. Introduction

1.1 Background

The aim of this thesis is to study the dynamics of the socio-technical development that takes place as information and communication technology (ICT) becomes a factor in the development of rural areas. ICT changes the way we organise society. Provision of services such as e-government, e-learning, e-health, and to enable a more dynamic e-business environment (eEurope, 2002, p. 79) facilitates regional economic development. To reap the benefit of these services, access to sufficient knowledge resources and infrastructure is necessary because of the increasing importance of information and information processing. Today's society, often called "the information society", signifies the increasing importance that information has as well as the ability to process it[1,2]. The information society offers both new opportunities and a threat to the current practices. Disadvantaged areas risk exclusion, whether it be economically, socially or culturally. This exclusion is often called the digital divide (Moran, 2005) and it signifies the difference between those who have and those who do not have the access to the same technological opportunities. ICT is in principle unbiased as regards the spatial location of users. Nevertheless, ensuring a balanced development between urban and rural areas is a challenge in the information society.

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[1] I have chosen to use the term "Information society". In the scientific literature, a number of concepts are used to describe contemporary society and what distinguish it from the industrial society. Concepts such as knowledge industry/ society (Machlup, 1962; Stehr, 1994), network society (Castells, 2000c; Dijk, 2006), post-industrial society (Bell, 1976; Tourain, 1971) and Information Society (Castells, 1994; Webster, 2002).

[2] I base my use of the term "Information Society" on "the Idea of an Information Society" (May, 2002, p.3), that is there is not one specific definition but it is a concept used to name the successor of the industrial society. Webster (2002) have identified five different, but not mutually exclusive, definitions of the Information Society; technological, economic, occupational, spatial and cultural. Each of the definitions emphasising different factors, but all share a "conviction that the quantitative change in information are bringing into being a qualitatively new sort of social system, the information society" (Webster, 2002, p. 9).

In my work, I have been intrigued by the divide that separates rural and urban areas. Here I need to define rural areas the way I use the concept. I use rural area to describe sparsely populated areas; the inhabitants live in small towns, villages or on farms and other more isolated locations. The concept rural area contrasts with urban area; that is, densely populated towns and cities. The distinction is not clear cut, but in my empirical work, rural areas are more important than urban areas. The region Sogn & Fjordane has some more agglomerated areas than others, but the numbers of inhabitants do not exceed 20,000 in any community.

In this introductory chapter I will first give an overview of the research motivation and process and research aims then move on to a closer description of the challenges for rural area, provide an introduction to the empirical setting and finally present an overview of the structure of the thesis.

1.2 Research motivation and Related research

The research reported in this thesis is the result of a long-term interest in the use of ICT in general, and more particularly, in how use of ICT can contribute to the development of rural areas. For more than a decade, this has been the connecting line through my research activities at Stiftinga Vestlandsforsking. The research carried out at Vestlandsforsking is applied research, studying ICT in a context. The context may vary from single companies to local groups, to business sectors, though the common denominator is the rural setting. A number of formal projects have contributed to the empirical basis for the thesis. These can be structured in two groups; first, related to the European Union funded project addressing use of technology and an organisational structure in and between European book towns and a comparison between this project and three other EU funded projects, and second, projects related to development and provision of broadband infrastructure.

The motivation for this work is that it is an opportunity to systematise, discuss and theorise about my observations of use of ICT and rural areas. The observations are made through research projects carried out over more than 10 years at Vestlandsforsking and concentrates on addressing the challenges posed by increasing use and dependency of ICT in rural areas. The development is more dependent on access to knowledge resources and infrastructure then in the industrial society. As a result, there is an increasing danger for larger social,

economical and digital divides, not only for rural areas but also in general between advantaged and disadvantaged areas. At the same time, I have observed that some rural enterprises manage to deal with the challenges, and local initiatives have been able to bridge infrastructure divides. Further, I have also observed that local knowledge needs, can be compensated by working together in networks. As a result, my focus is to understand the change processes that take place in rural communities (Figure 1) as a response to external, often global challenges.
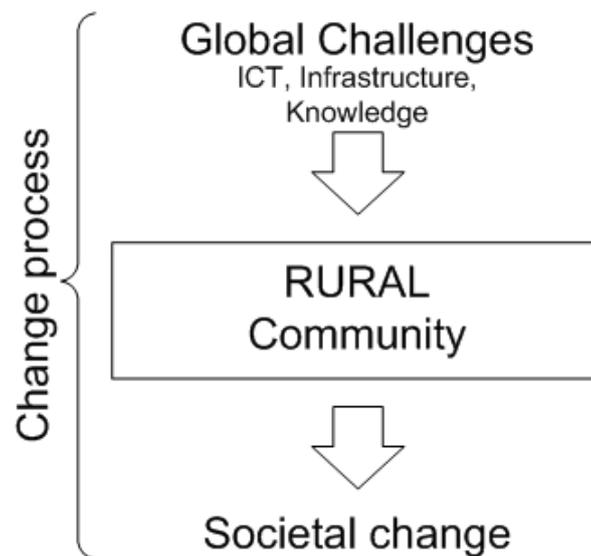
Figure 1 The focus of the thesis is on the rural community and response to global ICT related challenges

My research project started exploring the interplay between different network initiatives with focus on ICT use and development in the Sogn & Fjordane region. This moved on to a further study of the action research project BookTownNet[3] which have a European dimension and where I was the project manager involved in most parts of the process. The BookTownNet project was drawing to an end as my doctoral project started in 2000. The

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[3] The BookTownNet project was set up in 1998 and received partial funding from the Fourth Framework Telematics Application Programme of the CEC, DG XIII (project # UR 4001) and partial funding from the Ministry of Local and Regional Development (project # 00 22 02 76) and The Norwegian Industrial and Regional Development Fund (SND) (project #97/05167-002)

doctoral research has therefore explored the project in a historical perspective, trying to get a better understanding of the processes taking place. Paper 1 and 2 report this work.

The second study, a comparative study of four different European Union-funded projects, also used input from the BookTownNet project. In a collaboration of five researchers, two from Finland, two from Italy and myself, we compared characteristics among the projects. Paper 3 document the result of the study.

In parallel with the BookTownNet project, an initiative was started that focused on the availability of broadband infrastructure in the Sogn & Fjordane region. This initiative covers a number of projects in the region. Some of the projects have involved Vestlandsforsking and some were carried out independently, papers 4, 5 and 6 reports from this work.

1.2.1 Challenges in rural areas

One of the motives for this research is the achievement of a spatially balanced development of the information based on information and communication technology. Access to sufficient and inexpensive information infrastructures are an important part of this balanced development, and this is the reason I got an interests in information infrastructures.

In principle, poorer European regions have the same development potential as more prosperous regions (ESPD, 1999), although they have less opportunity to initiate development projects, of economic reasons, that would curtail a widening gap between prosperous and poor regions. This includes social, economic and digital divides. By supporting development projects focusing on use of ICT in deprived areas can be a tool in the process to reduce both the digital and other gaps. ICT is not the answer to all problems, but it is a tool for achieving certain goals. In each direct institutional and social context there is a need to consider the application of these tools. In most cases, ICT is only a part of the solution, as much effort is required for motivation and education of the user population.

<u>Urban and rural areas</u>

One important challenge is to ensure a balanced development between urban and rural areas. Small towns and rural area play an important role in the growth of regional economic development. Small towns are regional centres for provision of services. These areas are diverse in nature, some highly dependent on agriculture or the fishing industry, others depending on single industries, often a declining industry or one that through reorganisation can be run much more efficiently, thus resulting in increased unemployment. Many rural areas have a net out migration; in general young educated persons leave the area. Another vexing trend is that both general and public services become concentrated in large cities or towns, centralisation that undermines local delivery of services. This can create a loss in economic power in the rural areas. At the same time in urban areas there is good access to knowledge, there is a net in migration, there is many support systems for start-ups and established businesses, and there is easy access to public services. The urban centres have relatively higher economic power than the rural areas. These trends are creating a divide between urban and rural areas.

Statistical material (Nachira, 2002) points to two main digital divides when it comes to e-business in Europe. The divide arising from different rates of adoption of ICT has been perceived as a gap between the Nordic/Western and Southern/Eastern European member states. The picture is more complex than that. A closer look at the Nordic countries also reveals divides between regions in this area. Peripheral or rural regions are less developed than the urban regions. The second digital divide is one based on company size; there are significant gaps between small and medium enterprises (SMEs) and larger enterprises when it comes to the use of ICT, and especially with regard to e-business integration (eEurope, 2002).

<u>Access to infrastructure and knowledge</u>

Though many rural areas have adapted successfully and developed independently. Access to infrastructure and knowledge has been a key factor in this regard (ESPD, 1999; OECD, 2004). With good infrastructure facilities and access to information, rural areas have potential in terms of economic attractiveness and diversification.

Efficient transport and adequate access to telecommunication infrastructure is a prerequisite for strengthening the competitive situation of peripheral and rural regions. Sufficient access to telecommunication infrastructure has a key role in strengthening the economic attractiveness of both urban and rural areas.

Telecommunication networks play an important role in compensating for disadvantages caused by distance and low population density in peripheral and rural regions. This relates both to access to services and to employment opportunities. Tele-liberalisation has caused a disadvantage for peripheral and rural regions (Grubesic & Murray, 2002; OECD, 2004). The companies tend to cherry-pick in central areas, while the relatively small market volumes and high investment costs for telecommunication infrastructure in peripheral and rural regions have in many cases led to lower technical standards and higher tariffs. This makes peripheral and rural areas less able to compete with other areas when it comes to innovation and entrepreneurship. The provision of high-quality services at affordable prices is a key factor for regional development, also with regard to tele-working, distance education courses, tele-medicine etc.

Access to knowledge is as important for the competitive situation of an area as access to infrastructure. Knowledge, education and training are becoming an ever more important factor for economic participation and success. Regions with limited or unsatisfactory access to information and knowledge, because of a lower education level or lack of higher education, research and training facilities, are likely to have problems in maintaining the population. A particular problem is attracting people with higher education and more advanced skills to the region. Regionally interdependent labour markets and production and service locations require dynamic innovation systems, effective technology transfer and institutions for training their workforces. There is still a spatial imbalance in access to knowledge and the capacity for innovation. This requires a strong regional innovation and support system. Most new enterprises in the service sector focus on the delivery of non-material services. These enterprises require more qualified employees. In traditional industries too the expectation of increased productivity necessitates higher qualified employees as new and better products and processes are developed. Companies that can combine innovation and new organisational forms with a more highly qualified workforce are also able to position themselves better within the market in the long term, and can tap

into the global market. Strengthened links between enterprises, research and education and the public sector become essential.

ICT can help to reduce deficits in access to innovation and knowledge systems thus enabling the establishment of companies in rural regions. ICT can reduce the perceived distance to these services.

1.2.2 Related research

As described above, the use of ICT is changing the way we organise society. To be able to reap the benefits of these services it is necessary to have sufficient access to information infrastructures, i.e. to broadband infrastructure to be able to use advances systems for collaboration or transfer of large data. Rural areas tend to fall behind with regard to access and use of this kind of infrastructure (OECD, 2004).

The aim of the thesis is to make a contribution to the research area on development of information infrastructures (Hanseth, 2000b; Hanseth & Lyytinen, 2006; Monteiro, 2000; Star & Ruhleder, 1996) in a rural context. The thesis aims at giving both an empirical and theoretical contribution to the discussion of information infrastructures and their implementation in rural area. The rural context and the technological components are mutually influencing each other in the process of developing the information infrastructure. Technology is no longer a 'black box'; it is rather a collective or network of human and nonhuman components that is a socio-technical networks.

An infrastructure can be defined as a set of interconnected structural elements that provide the framework for supporting the entire structure. It usually applies only to structures that are artificial" (Wikipedia, 2006). An infrastructure can be looked upon as a network that connects an integrated and heterogeneous set of components (Shapiro & Varian, 1999) with certain inertia, that is; equipment, systems, applications, processes and people. Infrastructures exist in many forms; transportation (such as roads, public transportation), public utilities, telephone, electricity, public services (such as fire department, police, waste management) and national services (such as defence, postal, currencies). That is, all the basic structures needed to have a functioning community. An infrastructure needs to be managed and maintained to be sustainable.

The heterogeneity of the network makes it difficult to plan and design. Many infrastructures such as telecommunication infrastructures have traditionally been rolled-out as part of a top-down initiative by the large, often national telecom providers. The telecom providers have planned and installed their own infrastructure without much interaction and influence by local actors. The deregulation of the telecommunication market in 1998 changed this. It is no longer the norm to roll out new telecom infrastructure nationally, rather the market demand now determines where and when to extend the infrastructure.

This section has four parts, it first defines information infrastructure, and the next looks at the socio-technical development of information infrastructure. The third, explores cultivation as a bottom-up development strategy for information infrastructures and the section is concluded by summing up concepts that will be used later in the discussion, while open issues are brought forward to the following section 1.4 Research questions and aims.

Information infrastructure

The National Information Infrastructure initiative introduced the term information infrastructure. The National Information Infrastructure was launched by the Clinton administration in 1994 and describes the Internet as an infrastructure shared by the users. According to Hanseth (2000a) information infrastructures are; shared and a foundation for the community they support, and if taken away the community would notice its absence. Further information infrastructures are open and enabling, in that it supports a large variety of applications. In addition, information infrastructures are evolving, standardised, and heterogeneous.

All infrastructures are heterogeneous in the sense that they include different organisational and technical components connected together using standards and gateways. Looking at information infrastructures they can be decomposed into different layers representing simpler ones that offer 'one' function. According to Hanseth (2002; Hanseth & Lyytinen, 2006) information infrastructures can recursively be split in two layers: application and support infrastructures. Application infrastructures are what the user see and interact with and the support infrastructure, are the basis upon which applications are implemented. The support infrastructure can again be split into two layers: transport and service

infrastructures.   Example of a transport infrastructure is TCP/IP for Internet and for service infrastructures, are domain name server, directory, security or accounting functions. Standards and conventions are important parts of an information infrastructure and are linked to the development and use of the information infrastructure.   An information infrastructure is not an end in itself; it is the means or facilities that help to achieve something else; it is an invisible structure that becomes visible only in breakdowns (Star & Ruhleder, 1996).

Infrastructures as a Socio-technical development

Traditional approaches to information systems development are implicitly based on the assumption that an information system is a stand-alone system used within closed organisational borders (Ciborra, 2000).   On the contrary, when developing information infrastructure the focus is that the infrastructure is an open system that must interact with other neighbouring systems, often across organisational borders. According to Star and Ruhleder (1996) the question is not "what is an infrastructure", but rather "when is an infrastructure". This implies a view of infrastructures as something evolving over time. When changing or improving an infrastructure the new version has to fit with the existing infrastructure. The existing infrastructure, the installed-base, constrains and influences the design of new components and the evolution of the infrastructure.   In addition, the conventions of a community, a practice, or a working routine can both shape and be shaped by the infrastructure (Star & Ruhleder, 1996), and must be taken into consideration in the design process.   An infrastructure in this perspective is never developed from scratch; it builds on something and continuously interacts with it (Hanseth, 2002) and when changed or improved, the new version has to fit with the existing infrastructure. This 'something' is often termed the installed base.

Traditionally technology has been considered as a generic factor and ICT research has been regarded as a predominantly technical endeavour.   In such a perspective technology is viewed as the determining force (among other Monteiro, 2000, p. 73). The effect of the technology when moved into a social context or use context is pre-defined or inscribed into the technical artefact (Monteiro & Hanseth, 1995).   In contrast to this, is the social constructivist inspired research in which society or humans develop and use technology as they 'want' (Monteiro, 2000, p. 73).   In such a perspective, the technology is taken for

granted and regarded as a black box. These two perspectives can be considered the extremes. The intermediary position is a socio-technical co-development in which ICT both enables and constrains development (Monteiro, 2000, p. 73). The whole process of developing, introducing and using ICT systems is a process of negotiation between social needs and technical possibilities (Monteiro, 2000). In the past decade Actor Network Theory (ANT) have been used to address socio-technical issues in information systems research. Using ANT puts focus on the complexity of the socio-technical implementation of an information system. Such a network will comprise both human and non-human components such as; work practices, organisational routines, standards, information systems, computers and other technical artefacts (Hanseth & Monteiro, 1997).

An expanding body of literature address issues of the social, economical and institutional nature of information systems and information infrastructures in particular (Damsgaard, Rogaczewski, & Lyytinen, 1994; Kraemer, King, Dunkle, & Lane, 1989; Larsen & MacGuire, 1998; Lyytinen & Damsgaard, 2001). In this literature, information infrastructures are understood as a 'multi-layered' system including technical, organisational and human components. Both the characteristics of technical systems and infrastructures and the social context influence the implementation, adoption and adaptation of information systems in organisations. The point being that the outcome of the implementations depends upon both characteristics of the technical solutions, as well as the system development processes and the organisational and contextual factors.

Development of information infrastructures involves socio-technical change processes that bring together equipment, specialists, managers, policies and the users — all part of the local infrastructure and support system (Jansen, 1998; Kling, 2000; Skogseid & Jansen, 2001). Kling (2000) defines a set of characteristics that separate socio-technical models from standard (tool) models (see Table 1, next page).

Contrary to traditional infrastructures, information infrastructures are not designed or planned to be an infrastructure from the start, they evolve over time as part of a process (Star & Ruhleder, 1996). Both human and technological aspects need to be taken into consideration in the process.

Table 1 Conceptions of ICT in organisations/society (adopted from Kling (2000))

Standard (Tool) Models	Socio-technical Models
ICT is a tool	ICT is a socio-technical network
A business model is sufficient	Ecological view is also needed
One-shot ICT implementations are made	ICT implementation are an ongoing social process
Technological effects are direct and immediate	Technological effects are indirect and involve different time scales
Politics are bad or irrelevant	Politics are central and even enabling
Incentives to change are unproblematic	Incentives may require restructuring (and may be in conflict)
Relationships are easily reformed	Relationships are complex, negotiated, multivalent (including trust)
Social effects of ICT are big but isolated and benign	Potentially enormous social repercussions from ICT (not just quality of work life, but overall quality of life)
Context are simple (a few key terms or demographics)	Contexts are complex (matrixes of businesses, services, people, technology history, location, etc.)
Knowledge and expertise are easily made explicit	Knowledge and expertise are inherently tacit/implicit
ICT Infrastructure are fully supportive	Additional skill and work are needed to make ICT work

Cultivation – Bottom-up strategies for local infrastructures

The heterogeneity of information infrastructures makes them complex to plan and design. An example; traditional telecommunication infrastructure was rolled-out as part of a top-down initiative by the large national telecom providers. In a monopolised market, this was possible. The telecom providers planned and installed their own infrastructure without much interaction and influence by local actors. The deregulation of the telecommunication market in 1998 changed this. National rollout of new infrastructure is no longer the norm, now the market demand is the main determining factor for the providers when extending the infrastructure. In other domains, the networked computer on every office desk has changed computers from being a tool for specialists to become a tool for integrating information from different specialists toward new user groups and needs. Such an integration process between stand-alone systems can be an infrastructure development process taking care of both the specialists' needs and the new user needs. As a result, information infrastructures have become complex to design and develop and can no longer be rolled-out according to a master plan ─ there is a need for a different approach.

Hanseth (2002) develops a notion of cultivating an information infrastructure based on the available installed base. The concept of cultivation comes from the agriculture area and refers to the growing of plants or raising of animals. In the area of information systems cultivation have been used in relation to strategies for developing technological systems. Dahlbom and Janlert (1996) use the concepts of construction and cultivation to describe two different processes to shape technology. 'Construction' puts emphasis on the human ability to shape the world according to a set of goals. 'Cultivation' point to the process of selecting and assembling components but also to a process of growth or development in the material itself when we create a system. According to Hanseth (2002), cultivation as a concept involves considering technological systems as organisms with a life of their own, this turns focus to the limits of the rational and human control involved in the development.

When using a cultivation approach, a development is not a result of a big plan, but ensues from a discovery process, trial and error, nurturing the development through a process that is based on the available installed base (Aanestad & Hanseth, 2002). Another way of viewing this is as a process of negotiation, and coupling of components (Ciborra & Hanseth, 1998).

Hanseth and Lyytinen (2006) define two key design strategies for information infrastructures. Each of these has a defined set of principles and guidelines to make the development process simpler and to increase the success rate of the implementation. The strategy "Bootstrap-installed base" considers how to cultivate the infrastructure by focusing on usefulness for the first adapters and the size of the user groups as a way of ensuring momentum and creating a critical mass of users. Another way of building momentum is to extend the available installed base. When building on the installed base the new components need to be simple and inexpensive, but they still need to fulfil the main aim of creating a useful service. They must fill the connection to the existing entity using an interface based on standards and gateways, but it is also easier for potential users to connect to the infrastructure without making a total break from the known and existing entity. Improvements should be on a needs basis, rather than a "nice-to-have" basis. Throughout the whole process the alignment of interest must take place in parallel to the building process; part of this is also a process of developing a support community for the infrastructure. In this way, the new infrastructure is built brick-by-brick as part of a bottom-up strategy. The second strategy "Avoid technology lock-ins" focuses on simplicity,

modularisation and use of gateways between different layers and components and to neighbouring infrastructures. A lock-in situation is something that can happen over time as the infrastructure develops. By choosing simple and inexpensive components and designing for flexibility it may be possible to avoid lock-in situations.

The installed base will not be treated the same if you take a top-down or a bottom-up approach to the development. In a top-down setting, the installed base to consider is the one that is controlled by the developer. While in a bottom-up setting, the installed base will vary, it may be managed by different organisations and consist of various technical solutions. As a result, the complexity of the development increases and the negotiation between different stakeholders is necessary. In addition, it will not be possible to make a blueprint copy from one location to another because the installed base will vary from community to community. Infrastructure that is developed locally and will support the needs in a local community has to be developed using cultivation as a bottom-up strategy. The process is influenced by the local context and the culture. In extending the information infrastructure, modularisation of infrastructure components can make it easier to design and adjust to different contexts and to different installed base.

When dealing with a bottom-up cultivation of infrastructure, for instance, in rural areas, a high grade of complexity is encountered and there is a need to explore features of the available local installed base before and during the cultivation process. An installed base in general is the available infrastructure – the existing standards, technical and non-technical components needed to operate an infrastructure or develop it further – to cultivate it. An infrastructure is never developed from scratch, it is an extension to the existing installed base (Hanseth & Lyytinen, 2006); therefore there is always an existing installed base that can be cultivated. In a bottom-up process it is necessary to start by examining the installed base in a local community, to identify what is the starting point and identify actors that can be aligned and utilised in the cultivation process. In a rural setting and across organisational borders the process of exploring the installed base is complex and there are many factors to consider. One of the challenges is to identify the installed base and consider how to best utilise it in the design process. What is the installed base in a rural community? And, how can we identify the available installed base? And, how can the installed base be cultivated?

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Hanseth and Lyytinen (2006) claim that we need to draw upon and expand the existing installed base. However, they do not offer a framework for assessing and reflecting upon the installed base and its influence on the design of the new infrastructure. Using a bottom-up strategy is more complex than a top-down rollout, for instance with regard to number of actors and different technology.

<u>Summary of concepts brought forward to the analysis</u>

This section has discussed the cultivation approach for development of information infrastructures, and has identified issues relating to such developments in rural areas.
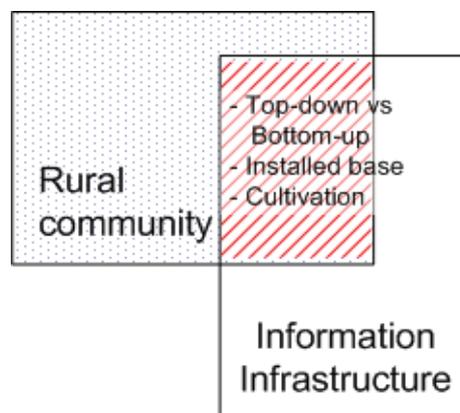
Figure 2 Information infrastructures concepts related to development of infrastructures in rural areas

There is particularly three concepts that I want to draw on from this walkthrough (see also Figure 2):

- *Top-down approach*: An information system is designed and developed using a top-down approach when the system designed is based on an overview without the details of the sub-systems, which are treated as "black boxes" in the design. Subsystems are then defined in more detail, reduced to basic elements.

- *Bottom-up approach*: An information system is designed and developed using a bottom-up approach when the basic elements are designed and developed first, these are then linked together to form subsystems which again are linked until a complete system is developed. The system implementation will be influenced by the context of the development, and even if the system as a whole may have little global usage the individual components may. As the system grows and components are linked together the complexity increases.

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- *Installed base*: An installed base in general is the available infrastructure – the existing standards, technical and non-technical components needed to operate an infrastructure or develop it further – to cultivate it. An infrastructure is rarely developed from scratch, it is an extension of an existing installed base therefore there is always an existing installed base that can be cultivated. Identifying the components of the installed base is therefore important for the outcome of a cultivation process.
- *Cultivation*: The concept of cultivation is used to develop infrastructure in a piecemeal growth; focusing on usefulness for first adapters, use of inexpensive basic components developing, trying out, evaluating.

1.3 Research questions and aims

The thesis focus on the challenges that participation in the information society constitute for rural areas, this is both with regard to access to sufficient infrastructure and with regard to development and use of information infrastructures in rural areas. The thesis is both exploratory and interpretative, probing the interplay between technical development and social change. The empirical work has been exploratory in that I have approached the cases without clear hypothesis and question or any theoretical or analytical models. It is also exploratory because I have been following ongoing development processes in local communities and the way they actually develop. At the same time it is interpretative in the analysis, developing a deeper understanding of the phenomenon in an iterative process.

For exploring the empirical work the research questions are as follows:
a. In relation to internet tools and access to sufficient broadband infrastructure in rural area, what are the factors at local level contributing to and influencing the uptake and development of information infrastructures?
b. How can the installed base be identified and cultivated in a rural community?
c. Which dynamics enable rural communities to adapt global challenges in the context of information systems and infrastructures?

While the included papers are reporting on the empirical experience and theorising about those it is the aim of the thesis as a whole to synthesise across the cases and empirical work. The aim is to contribute both to the theoretical domain of information infrastructure

development in a rural setting, and to point at implication for real life initiatives addressing information infrastructure development in rural areas.

1.4 Empirical setting

The empirical setting of my research is characterised by the issues brought up in the region Sogn & Fjordane in western Norway, but have been supplemented with comparisons to other Rural projects in a European setting.

Three different studies are included in the thesis; one is a study of a European Union funded project BookTownNet[4] that took place in the period 1998 – 2000. After the project finished I have kept contact with the network, and have been allowed to follow their operation, but as an observer. This case was also part of the second study, a comparative analysis of four European Union funded projects. The third study relates to the broadband development in Sogn & Fjordane exploring local/regional processes to ensure access to adequate broadband infrastructure. The broadband process started in 1998 with the liberalisation of the telecom market and it is still an ongoing process. Each case is further described below.
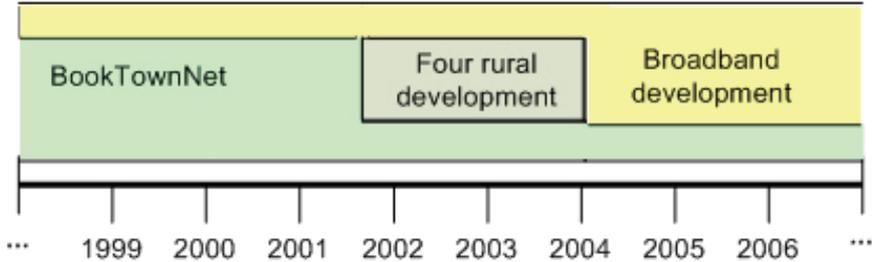
Figure 3 Timeline for studies

My studies are based on cases that were initiated, at least in part, with the aim of improving the conditions in particular rural regions, thus ensuring better opportunities for development in the information society. Below is a short description of the empirical setting of the studies.

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[4] The BookTownNet project was set up in 1998 and received partial funding from the Fourth Framework Telematics Application Programme of the CEC, DG XIII (project # UR 4001) and partial funding from the Ministry of Local and Regional Development (project # 00 22 02 76) and The Norwegian Industrial and Regional Development Fund (SND) (project #97/05167-002)

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1.4.1 The BookTownNet case

The story behind this case dates back to the early 1960s, when the young Richard Booth founded the world's first Book Town in the small rural Welsh village Hay-on-Wye, which was threatened by economic decline and migration. His idea was to turn this depression into growth by selling second-hand and antiquarian books. Initially, nobody had faith in the idea, but in the span of more than 40 years since the first book town was established in 1962 (Seaton, 1996) nearly 30 book towns (for a list see Appendix G) have been established worldwide to date and several more are under development. The idea has spread all over Europe, the US and the Pacific region, and a number of such book towns play a significant role in their local economies. Most book towns have developed in villages of historic interest or scenic beauty. So a conservation of cultural heritage has gone hand in hand with retaining a unique local atmosphere. As the number of book towns increased, the need for more and better communication to such villages also increased.

By the mid 1990s, however, the new economy based on ICT and in particular the Internet represented a new challenge for the old-fashioned bookshop. In 1996, representatives from five of the villages took an initiative to face these challenges and decided to establish an organisational network (a project) that would strengthen the ties between bookshops and book towns, a Book Town Network. In addition to Hay-on-Wye (GB), the other villages are Bredevoort (NL), Fjærland (NO), Montolieu (FR) and Redu (BE). The aim was to establish an ICT infrastructure that would support an organisational network between the book towns, enabling both the bookshops and the book towns to have a common communication channel between each other and to the wider Internet audience.

Table 2 Overview of participants in the project

Book Town	Participants	Characteristics
Hay-on-Wye (GB)	1 bookshop	Population: 1,500; Established 1961; 36 bookshops; 500,000+ visitors
Redu (BE).	1 bookshop	Population 450; Established 1984; 22 bookshops; 200,000+ visitors
Montolieu (FR)	3 bookshops book town organisation	Population 850; Established 1989; 12 bookshops; 100,000+ visitors
Bredevoort (NL)	3 bookshops book town organisation	Population 1,600; Established 1993; 25 bookshops; 100,000+ visitors
Fjærland (NO)	2 bookshops book town organisation	Population 300; Established 1995; 14 bookshops; 30,000+ visitors, Only open in summer season
	University of Luton	Research in Tourism development
	Western Norway Research Institute	Research in use of information technology

The villages have a population of between 300 and 1,600, from 12 to 36 bookshops and up to 500,000 visitors in a year. In the individual villages the relationship between the bookshops is characterised both by a high degree of collaboration in developing the village and attracting visitors and by a high degree of competition in selling most books. This is mirrored across the villages: they perceive the benefit of working together as a *global village* while individually want to attract most visitors.

1.4.2 Four Rural Development projects

This comparative study looked at four ICT based rural development projects. It was a joint effort between five researchers: two from Finland, two from Italy and one from Norway. The authors belonged to the same working group at a working conference for doctoral students in 2001. The organisers had placed the authors in the same group because we all had a focus on virtual communities. Four of us contributed information about our independent cases; all four cases received funding from different European Union programmes. The four cases are:

- The IT-Families: received partial funding from European Unions regional development fund.
- The BookTownNet project (UR 4001) received partial funding from the European Commission DG XIII Telematics Application Program for Urban and Rural Areas

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- The Mediasite project: received partial funding from Telematics Applications Program of the European Commission, DG XIII, "Telematics for Integrated Applications for Digital Sites"
- The "Valley Net" project: received partial funding from the European Union's regional development found

We first presented the paper at a conference (Botto, Gripenberg, Silli, Skogseid, & Tuunainen, 2001) on the basis of discussions at the workshop and continued e-mail communication. Based on the feedback at the conference and the following discussions, Pernilla Gripenberg and I reworked the paper and got it published in 2004. The result was a publication of an article in the journal *The Information Society* in 2004 (Gripenberg, Skogseid, Botto, Silli, & Tuunainen, 2004).

1.4.3 The Broadband development case

The Sogn & Fjordane rural 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, resulting in an average of about 6 persons per square kilometre. The region is characterised by scenic but harsh nature with glaciers, mountains and fjords dividing the populated areas.

The inhabitants are spread over large parts of the region with only a few agglomerated areas. The industries are largely 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, foundries and metal industries, hydro power/energy and tourism. The region has the largest export per capita in Norway (4.6 % of the country's total exports). Together this makes the region very challenging to develop, particularly with regard to broadband infrastructure. For commercial providers the cost of cabling the whole region is too high and the demand is too low.

The deregulation of the telecom market has significantly changed the way that infrastructure is developed. Because of the deregulation, the development of new infrastructure occurs in a competitive market. Telecom operators are not likely to develop broadband infrastructure in rural areas because of high cost and insufficient demand (OECD, 2004). Even when built on top of an existing infrastructure such as the phone lines, the cost of developing broadband

access is two high compared to demand. At the time of the 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.

The government has initiated mechanisms that can increase the demand for broadband services. This instrument, called 'HØYKOM' (2002; 2006), is particularly aimed at rural areas. It supports regional and local governments by partially funding the acquisition of broadband access and development of broadband services in the public sector. This is a welcome contribution but the local and regional government must still provide the main part of the investment, which can be difficult. When the local and regional governments provide services requiring broadband capacity, it is also necessary for the residents and businesses to have equal access so they can utilise these services. Because of this situation, a number of broadband providers have been established. A study done in 2004 identifies 130 broadband providers in Norway. This study did not identify all and it estimated the existence of at least 150 providers (Norsk_Telecom, 2004) in Norway. About 10 of the 130 named providers are classified as national providers, delivering broadband services with national coverage. About 40 are what they define as regional actors and the remaining 80 are characterised as local providers, serving local communities. One of the reasons for the many small local providers is that municipalities often have an important role in the local initiatives. In about 50 of the 130 companies, municipalities participate as owners (Norsk_Telecom, 2004). This is in line with the findings of the OECD (2004) study of broadband access in rural and remote areas. It found that the result in rural areas is "sometimes surprising and counter-intuitive ... There is a rapidly increasing amount of new private sector entry occurring in the provision of broadband access in rural areas" (OECD, 2004, p. 4). These providers deliver high quality service at a competitive price. Some of them will survive, but others will not.

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

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Sogn & Fjordane is a rural region. At the time of the liberalisation of telecoms in 1998, very few organisations had access to high-speed communication; the cost-benefit ratio of the investment was too high. In an effort to get broadband access and be able to compete with more central areas in establishing new businesses and public services, a number of local initiatives have been taken to bridge the broadband divide. As a result of these initiatives, some which have functioned nearly a decade, the region has a broadband DSL coverage of 79.36%[5], though the coverage varies from 34.51% to 97.16% among the 26 municipalities in the regions.

To meet the challenge a number of regional and local initiatives have been taken, utilising existing relational and organisational networks and establishing new where needed. A total of 12 local initiatives are ensuring that large areas of the region now have access to broadband infrastructure. Nine of these initiatives are part of the study by Norsk Telekom (2004). Table 3 (next page) lists all the initiatives with a short description of main characteristics.

Each of these initiatives covers only a part of the region Sogn & Fjordane and all are the result of a local initiatives. The Enivest company is the only that may be considered a provider with regional coverage. The national provider Telenor is from 2005 present in all 26 municipalities in the region, providing DSL service in central parts (BBF, 2005).

In addition to the local providers there is a regional initiative called Broadband-forum Sogn & Fjordane (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 utilisation 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

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[5]According to http://www.jara.no/produktlosninger/bredbaand/priser_avtaler.html# the current coverage is 79.36%, over the last year the coverage have increased with 5.11% from 74.25% [Accessed 02.06.2006]

education. The national broadband plan stipulates that market forces should form the basis for new infrastructure development. By ensuring the information flow and exchange of experience, the forum is supporting the demand side, thus bolstering the call for broadband service in all parts of the region.

Table 3 Overview of broadband initiatives in the region Sogn & Fjordane as of June 2006. The two initiatives marked with * are discussed further in the papers.

Initiative	BB since	Owners/ involvement	Infra- structure	Users/Use	Operation	Coverage municipality
Aurland & Lærdal breiband	2003	Ltd owned by 2 Municipality + 2 el. suppliers	Existing cable-TV &ADSL & wireless & fibre	Sogn Breiband	Internal operation	Aurland & Lærdal
Datapart	2002	Ltd company	Wireless & ADSL	Private & businesses	Internal operation	Luster & Sogndal
Enivest	2000	Ltd owned by 4 municipalities and 3 el. suppliers	ADSL & wireless & fibre	Private & businesses	Internal operation	Nine municipalities
Firdanett * (was bought by Enivest in 2004)	2000	Ltd company owned by el. supplier	ADSL & wireless	Private & businesses	Internal operation	Gloppen
Jølster Breiband	2002	Ltd company	Wireless	Private & businesses	Internal operation	Mainly Jølster
Kapasitets-laget *	2000	Ltd Company	Fibre	Businesses & public sector	Outsourced operation	Sogndal, Leikanger, Luster
Sogn Breiband	2005	Ltd company	Services on top of ALB	Private & businesses	Internal operation	Aurland & Lærdal
SicoData	?	Ltd company	Wireless & ADSL	Private & businesses	Internal operation	Stryn
ViaVest	2000	Ltd joint venture between companies	Wireless & leased lines	businesses	Internal operation	Stryn
Vik IT-Partnar	2002	Ltd company	Wireless	Private & businesses	Internal operation	Vik & Balestrand in coop. w el. supplier
Zet.no	1998	Ltd company	Wireless & fibre	Private & businesses	Internal operation	5 towns
Årdalsnett	2001	Ltd company 12 local owners	Existing cable-TV & wireless	Private & businesses	Internal operation	Årdal & Lærdal

1.5 Organisation of the thesis
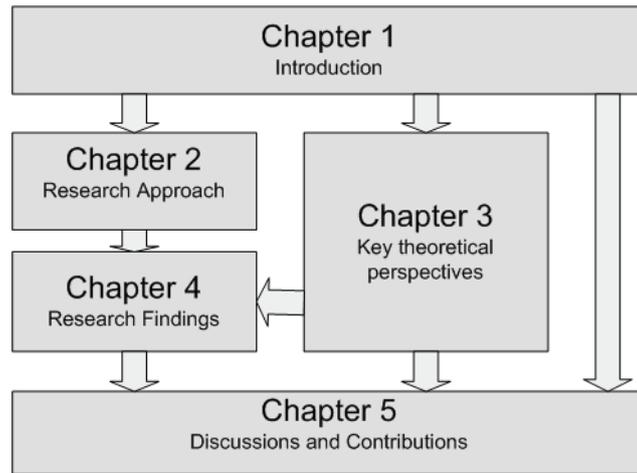
Figure 4 Structure of the thesis

This thesis is organised in five chapters (see Figure 4). In this introductory chapter, I have presented the thesis including research motivation, a general background to the area, and an introduction to the empirical setting for the thesis. Chapter 2 presents the research approach and research strategy given the empirical setting. Chapter 3 explores the key theoretical perspectives chosen for the thesis. Chapter 4 presents the research findings from six papers. The final chapter 5 presents the discussion and contribution. The 6 papers are included in the appendices.

2. Research Approach

2.1 Introduction

In order to identify technology as part of society, those educated in the design, implementation and use of information technology need "to have a reflexive distance to the internal technological issues" (Skjervheim, 1996b, p. 200, my translation). In carrying out this thesis, I am trying to take such a reflexive distance. After having worked on a number of applied research projects at Vestlandsforsking, starting the PhD work was taking a step back to create a reflexive distance, looking at the interplay between the technological projects and their contextual settings.

2.2 Research approach

The research is based on a qualitative epistemology. The qualitative epistemology has its origin in the social sciences (Myers & Avison, 2002, p. 4). It has been created to "enable researchers to study social and cultural phenomena" (Myers & Avison, 2002, p. 4). Qualitative methods such as action research, case study research and ethnography, are based on a small number of samples and a large number of variables about the case. The data gathered can be one or a combination of observations, interviews, documents, questionnaires and also the researcher's impressions and reactions (Myers & Avison, 2002).

In contrast, quantitative methods, originating from natural sciences, are based on quantitative data i.e., data based on large numbers of samples and a small number of variables about the object. The large amount of numerical data that represent values or levels in variables are processed in numerically or statistically as a basis for theoretical constructs and concepts (Straub, Gefen, & Boudreau, 2004). Interpretation of these numbers is seen as strong evidence of how a phenomena work.

Within qualitative information systems research there are different philosophical perspectives and the distinction between them is not always clear when carried out in the

practice of social research (Myers & Avison, 2002 p. 5-6). Orlikowski and Baroudi (1991; 2002, p. 55) suggest three categories: positivist, interpretative and critical. Their derivation is based on the underlying "philosophical world view" of the research.

The positivist epistemology focuses on the objective account of the observer (researcher). Orlikowski and Baroudi (1991; 2002, p. 55) describe positivist studies as "typically investigated with structured instruments … primarily to test theory, in an attempt to increase predictive understanding of a phenomena." Such studies assume that measurable variables can be collected, variables that can be measured objectively independence of the observer.

The interpretative epistemology reject the idea of an objective account of a phenomena, they rather "create and associate their own subjective and inter-subjective meanings as they interact with the world around them" (Orlikowski & Baroudi, 1991; 2002, p. 55-56). Interpretative research does not pre-define dependent and independent variables, but relies on the human sense made throughout the lifetime of the case. Instead of generalising from one setting to another, a deeper understanding of the phenomena can be used to inform the new settings.

My research primarily falls within the interpretative epistemology, developing deeper understanding of a phenomenon with an aim to use the knowledge to inform the development in other settings. One paper is based in critical epistemology. Critical studies shed light on the oppositions, conflicts and contradictions in society that comprise a critique of "status quo". The critique is a change force to induce change in the society, although their ability to achieve such change "is constrained by various forms of social, cultural and political domination" (Myers & Avison, 2002, p. 7).

Before moving on, I want to explore some more interpretative epistemology and methods. Interpretative methods are based on knowledge about reality. Knowledge about reality is socially constructed (Klein & Myers, 1999; Walsham, 1993, p.5; 2006). Skjervheim (1996a, pp. 71-87) discusses the distinction between "participant and observer". A participant will understand oneself and others in a different way then an observer does (Skjervheim, 1996a, pp. 71-87). This dichotomy between observer and participant exemplifies the critique from the positivist epistemology and in particular the quantitative positivist epistemology and the belief in objective knowledge creation. As an observer, the

researcher would place him-/her-self outside the realm studied as if his or her existence were timeless and therefore able to identify a replicable and objective reality. If replication of such a reality were possible it would mean to rid the actors of their individual choices, but society does not work like that. Whereas in the interpretative epistemology, knowledge about an objective reality is based on humans and human actions. The researcher is not removed from the reality studied; he or she takes part in it as a participant.

The interpretative epistemology is "aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by its context" (Walsham, 1993, p. 4-5). The approach takes both socio-technical and socio-cultural aspects of the construction into consideration. 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 the interpretive analysis is to understand rather than to predict a development.

Within the interpretative epistemology typical research methods are; case studies, action research, ethnographic research and grounded theory. Research methods are what links the research design to the epistemology (Myers & Avison, 2002, p. 7). Several of the research methods exist in both a positivist, interpretative and critical epistemology. In addition, independent of epistemology, they bear some things in common, while other aspects are important differences.

Case studies can be considered a method under each of the three epistemologies, positivist, interpretative and critical, (Myers & Avison, 2002). Case studies aim at creating an understanding for a process; the "how" and "why" (Yin, 2003) things happened. Case studies are an empirical inquiry into a real-world context (Yin, 2003, p.13). Positivist case studies are based on the belief that research is value-free and the researcher can observe the real-world context in the same way as he or she observes nature (Benbasat, Goldstein, & Mead, 1987; Myers & Avison, 2002). Opposed to this positivist perspective, the interpretive case studies consider the researcher as part of the same socially constructed reality, there is no "objective reality" that can be discovered by research and replicated (Walsham, 1993). There is an inter-subjective reality rather than an objective reality.

Critical research in general and critical case studies (Ngwenyama, 1991) make an explicit value choice with the aim of improving human conditions.

Action research like critical research has the improvement of human conditions as its objective. Action research can be traced back to the 1940s. In addition, to contribute to scientific knowledge production the aim is to contribute to solve practical situations or problems in the context under study. Another distinctive feature is that the community and the researchers are working together to solve the problem, the researcher has a "helping-role" (Baskerville & Wood-Harper, 1996) within the community or organisation. Action research is a cyclic process consisting of diagnosing, action planning; action taking; evaluating; and specifying learning (Baskerville & Wood-Harper, 1996). The work is carried out in close co-operation between future users, researchers and other stakeholders, the aim being to link theory and practice (Baskerville & Wood-Harper, 1998).

2.3 Research strategy

A research strategy needs to be chosen to fit the empirical/contextual setting that is being studied. The strategy applied in relation to my research is exploratory and interpretative. The research behind this thesis has been exploratory in two ways. First, I approached the empirical material without a hypothesis or research question. Second, the thesis is based on community initiated projects, not specifically designed for the doctoral work, and which I followed as it developed. Third, working with social change and technology, the issues raised do not all match one theory; they do not invalidate the theory, they simply fall outside the realm of the theory. In trying to grapple with the issues relating to the interplay between technology and society in a rural setting, an important part of the work going into this thesis has been to search for theoretical contributions, approaches and related research that give a better understanding of the issues at hand. As a result, my work on the PhD has been inspired by an array of theoretical approaches and related research in several areas.

It is interpretative in that it is descriptive rather than trying to identify causal explanations for the phenomenon. The aim has been to develop a deeper understanding of the interplay between technology and the contextual rural setting. The contextual setting is not something abstract, which surrounds the introduction of ICT; it rather refers to a set of socio-technical factors influencing such an introduction. Further the work of exploring the

case studies are historical explorations of developments studying available literature and written documentation of processes supplemented by qualitative interviews. At the same time it is an interpretative analysis, developing a deeper understanding of the phenomenon in an iterative process, across cases.

The empirical material for this research is based on three different studies, each of which has applied a number of different research methods. The primary approaches used are case studies; based on interviews, observation and document; action research, based on a two-year project where I participated in the process as project manager but was also involved in other parts of the project process; and comparative analysis of four longitudinal studies. Table 4 below gives an overview of the three different studies with regard to methodology, type of data and mode of analysis.

Table 4 Overview of research projects and methods (Inspired from Gripenberg (2005))

	BookTown.Net project	**Four Rural development projects**	**Broadband projects**
Method:	Longitudinal case study A type of action research Interpretative Historical perspective	Four Longitudinal case studies A type of critical, comparative approach Action research studies	Longitudinal case study Interpretative Historical perspective
Type of data:	Qualitative & quantitative	Qualitative & quantitative	Qualitative
Data collection:	Interviews Surveys Participant observation Documents /meetings	Metadata from four studies	Documents /meetings Interviews Surveys
Mode of analysis:	Exploratory Descriptive, Inductive	Exploratory Descriptive, Comparative, Critical	Exploratory Descriptive, Comparative Inductive
Reported in:	Paper 1 & 2	Paper 3	Paper 4 & 5

Underlying all three projects is a research design based on an exploratory approach. The exploratory approach is tied to the interpretative epistemology. Within the interpretative epistemology, the research methods applied are case studies and action research. Research methods are what links the research design to the epistemology (Myers & Avison, 2002). Coming from an applied science and action research setting the research strategy is in many ways a process of knowing-in-action and reflection-in-action (Schön, 1991). Knowing-in-

action is the utilisation of tacit and explicit knowledge in decision-making. Reflection-in-action refers to the way professionals deal with problem situations "thinking on your feet"; "learning by doing" refers to notions that exemplify the process of reflection-in-action. Schön (1991) describes the process of actions, recognitions and judgements that we do in our everyday job that gets us through the job, but when stuck we start to reflect on our actions taking in all available information, patterns of action, and know-how to decide on the next step of action; reflection-in-action. This is a process of framing a problem, the definition of the problem, implementation and improvisation, usage of metaphors and on-the-spot experiments are used to support the reflection-in-action through a "conversation with the situation" (Schön, 1991).

The selection of cases was not simply random nor was it a result of a rational choice made specifically for the thesis ─ other considerations were guiding the choice of cases. Working in applied research there is a need to have a long time perspective on the research; the individual commission may not be of direct use for the overarching research questions of interest. The researcher does not always have a choice, but needs to utilise available opportunities.

Case studies were chosen as a method because they are well suited to study ICT in social settings, the focus is not on the technical aspects of the technology but on the social or organisational aspects – focusing on the socio-technical interplay. Case studies are often used to investigate and understand connections and relations in real world settings (Walsham, 2002; 2006). The three studies used in this thesis lasted from two to six years. The studies have involved visits to the sites of the study and also data collection from interviews and documents. The critique of case studies has been related to generalisations, how to generalise from a single case? According to Yin (2003) theoretical propositions are generalisations of case studies. While Walsham (2002, p. 111) gives example of four types of generalisations; 1) "Development of concepts", 2) "Generation of theory", 3) "Drawing of specific implications" and 4) "Contribution of rich insight". My contribution in this thesis is a contribution of rich insight into the domain of the different case studies and as a contribution to generation of theory relating development of rural areas and information infrastructures.

2.3.1 Data analysis

My background is from computer science and user interface design. The first has a focus on operating system level functions in scientific computers and the second on the dos and don'ts of user interface design. Moving on from these perspectives with a focus on the causal effects between technology and its users it was difficult to understand and explain the interplay I observed as part of the projects I have been involved in while employed at Vestlandsforsking.

In the same period, there have been considerable changes in the way we use and perceive computers. Significantly there has been a shift from the perception of computers as a tool for the specialists and especially interested to computers being owned by almost every household and considered part of daily life. Computers have also become networked, connected to the Internet and instead of computers we now talk about information and communication technologies. With these changes, computers have increasingly influenced society, and social change processes and the opposite is also true the social context have also influenced the development of the technology. Such a socio-technical network brings together equipment, specialists, managers, policies, and the users all part of the local infrastructure and support system (Jansen, 1998; Kling, 2000; Skogseid & Jansen, 2001).

In such socio-technical networks, technology and the social context cannot be seen as separate, but rather as intertwined entities (Dahlbom, 1996; Kling, 2000). In this way technology is not a force influencing society form the outside but an integral part of a social phenomenon (Dahlbom, 1996; Kling, 2000; Skjervheim, 1996b). As a result, studies of socio-technical networks focus on specific technologies in specific settings, these studies develop concepts and theories, which inform other processes.

ANT has inspired my research and has been a tool for understanding the socio-technical interplay. Concepts from actor network theory (Callon, 1999; Latour, 1987; Monteiro & Hanseth, 1995) have been used to explore the initiatives in dynamic and historical perspective (Granovetter & McGuire, 1998, p. 149). The creation of an actor network involves linking a number of heterogeneous 'things' (Monteiro, 2000) through the enrolment of actors and the translation of their interests and ideas into the network and thereby aligning them (Callon, 1999; Walsham, 1997). In my work ANT has been used in the analysis to explore the development and identify actors and their influence on the

alignment of the network and they have been an important for understanding and describing the development of the network and the roles and relationships of the actors involved. ANT concepts are not explicit in the descriptions.

The analysis of data have in part been historical exploring the case material, documentation from the process from formal documents, minutes, designs etc and through personal reflections on the process as it was unrolling. ANT concepts have been used to explore the unfolding of the development, the alignment of interests etc. this exploration of the case has generated a set of notes which then form the basis for a more organised set of insights. Then again aspects from the theoretical perspectives have been used to analyse the data and to identify interesting aspects and learning's from the cases, or they have formed the basis for further data collections and analysis.

2.3.2 The BookTownNet case

At the time I started my doctoral work, the BookTownNet project was about to end. In my role as project manager, I was involved in most parts of the project in one way or another. As part of the project, we carried out interviews, surveys and were doing observations of the other participants. In addition, formal and informal documents were written. All this formed the basis for my exploration into the unfolding of the development in an historical perspective.

The project lasted two years, but involvement with the book towns commenced in 1996 with the unsuccessful application for the REGIN programme. It continued through the definition of the project application and negotiation in relation to the Telematics Applications programme under the Fourth Framework Programme. Following the completion of the project, the contact has sustained and I have been operating as an external expert for the International BookTown Organisation. Through this longitudinal process, information, observation and documents have been collected and have formed the basis for the historical exploration of the case.

From this point of departure, I explored the case through different lenses. A number of papers have been developed exploring diverse parts and aspects of the process, two of the

papers are included in this thesis (Paper 1 (Skogseid & Jansen, 2001) and Paper 2 (Jansen & Skogseid, 2003)).

2.3.3 Four Rural Development projects

This effort is also part of the historical reflection on the BookTownNet project. The study compares the result of four projects funded by the European Union. All sought to support learning and better use of ICT in rural communities and to tie actors together in a kind of "virtual community", meaning technology was used to connect persons who were located in different geographical space or who did not meet in reality.

Metadata about each of the cases was utilised as input to the comparison. By metadata, I here refer to project descriptions, project aim, number, descriptions and roles of actors, demographics, and information about technology. The source of data was comprised of documents relating to the projects and based on the individual experience of the researchers who were involved. These metadata formed the basis for the descriptions and analysis of the cases in relation to the literature that was our lens to the analysis. This work is included as Paper 3 (Gripenberg et al., 2004) in this thesis.

2.3.4 The Broadband development case

This case explores a longitudinal process, which covers the years from 1998 until today, and which involve activities at both regional and local levels. At the regional level I started out following the process as a participant observer (Baskerville & Wood-Harper, 1996; Cole, 1991), but as the process stabilised my involvement in the development has become more detached, and my main source data has been documents, status reports, project reports, and applications for continued funding. In addition, three of my colleagues have been active in the process as project managers, consultants, change agents etc. Dialog and discussions with them have helped considerably in filling in some gaps. Data has been gathered as part of the process through the interaction, participation and observation of meetings and activities.

At the local level, data has been gathered as part of a combination of an interview with companies that offer broadband and surveys of broadband offers in the region. Updated

versions of a status report have been released in a frequency depending on the activities. Early on in the process there were many status reports published, while lately the report has been updated less frequently because there are no longer so many changes. Additional sources of information have been the websites of the initiatives, project reports of those with public funding and interviews with some key actors in some of the local initiatives to complete the picture. My analysis of the initiatives has been in a historical perspective (Granovetter & McGuire, 1998, p. 149).

Table 3 (page 22) gives an overview over the different Broadband initiatives. Figure 5 below shows the broadband coverage in two snapshots in 2002 and in 2006.
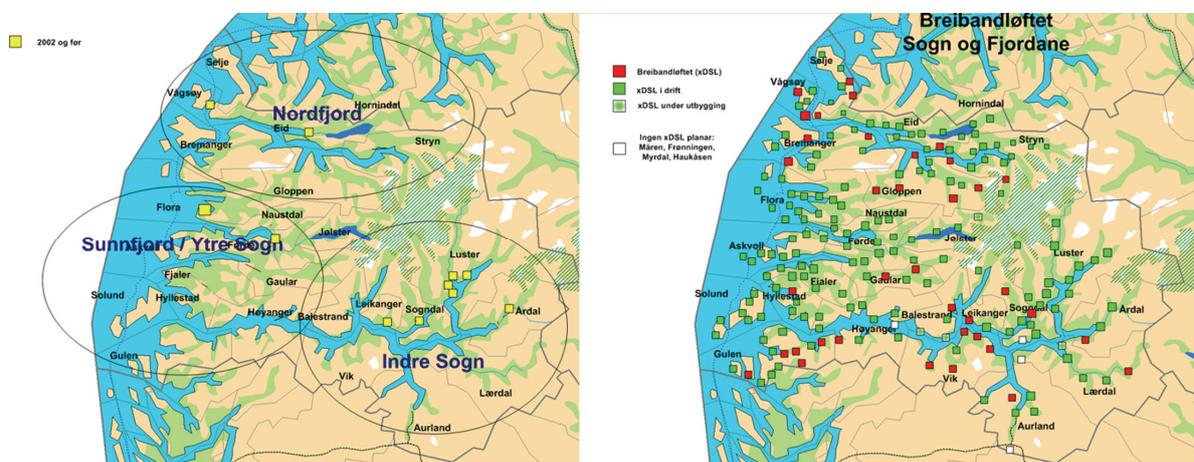
Figure 5 The map on the left shows access points for broadband coverage in 2002 and the one on the right shows the coverage in 2006 (Vorland, 2006).

This case is described and discussed in Paper 4 (Skogseid & Strand, 2003), Paper 5 (Skogseid & Hanseth, 2005) and Paper 6 (Skogseid, 2007) in this thesis.

3. Key Theoretical Perspectives

Chapter 1 provided input to the research motivation and related research. In this chapter I will present two key theoretical perspectives which help to address the research aims of the thesis, and which also have been important in the analysis of the cases. I have chosen to draw on two main strands of literature: networks and innovation systems, each described in this chapter. The first sheds light on networks in general in contemporary society, networks linking social and technological components creating global challenges (see Figure 1), and the linking between these challenges and the rural response. That is the networks are both the creating global challenges and are part of the relational resource that enables local development through conversation and co-ordination. The second body of literature shed light on the innovation systems. This involves exploration of the regional innovation system to identify the dynamics which enable local adaptation of global challenges and better ways of supporting socio-technical change processes in rural areas.

This rather broad approach is exploring cross section of three perspectives; information infrastructure, networks and innovation systems. The perspectives mainly originate from different traditions, Sociology, Information systems and Geography. The choice of perspectives is not one based on specialisation but are trying to address what has been observed in the different studies. The process have helped me develop an understanding of the dynamics that takes place locally, as ICT is becoming a factor in the development of a rural area and to get a better understanding of the factors contributing to uptake and development of ICT and the local adaptation of the global ICT challenges.

The introduction of computers and their data processing capabilities has triggered countless organisational innovations. Further, the growth of the Internet has been a new source of organisational innovations. One of the results of such a development is that urban and rural communities to a much larger extent than before are influenced by and dependent on changes happening in other parts of the world, that is, influenced by global challenges. The dynamics between global change processes and rural change processes are therefore essential for further development. This dynamic is dependent on the networks which

connect rural areas to national and global networks or arenas. The process of creating such a development and opportunities is no longer simply a financial question — it is about utilising the reflexive human capital of co-ordination and conversation. The ability to co-ordinate and plan actions, carry them through and learn from these actions is vital.

In the chapter I will first discuss the two key theoretical perspectives and how they relate to information systems in a rural context. Secondly, I will synthesise the three perspectives (information infrastructure, network and innovation systems) in a research framework and look at how they provide insight into the research topic.

3.1 Network

In my research, it has been important to understand the network processes taking place locally as a response to global challenges and how rural communities respond to these challenges. I base my understanding of a network on Törnquist (1997, p. 38-39) and Castells (2000c, p. 501); a network is a set of interconnected but discrete nodes. There is a difference between the nodes that are connected and those that are not. The nodes in the network are individuals or groups of actors (both human and technical) and the network links together different capabilities and knowledge. Common interest or relations and the communication of ideas and impulses along the links in the network are what connects the nodes (Castells, 2000c; Törnqvist, 1997, p. 38-39). Accumulation and development of knowledge in the network arises through communication between the nodes, often called the flow of information (Castells, 2000c; Mosse & Sahay, 2001).

This section has five parts, it first takes a look at some of the characteristics of the global networks in relation to rural regions and communities, then follows a section on networks as socio-technical development, then follows two sections on network characteristics and counter networks before concluding the coverage of networks by summing up concepts that will be used later in the discussion.

3.1.1 Global networks and rural regions and communities

My point of departure was Manuel Castells' writings on the network society (Castells, 1996; 2000b; 2000c; 2000d) in which networks are described as an increasingly important part of

society, a "new social morphology of our society, and the diffusion of networking logic substantially modifies the operation and outcomes in processes of production, experience power and culture" (Castells, 2000c, p. 469). That is a new kind of economy, the network economy (Castells, 2000b; 2000c; Dahlbom, 2000; Malone & Laubacher, 1998) and the development in information technology is one of the factors which enables its growth. This new economy is said to be informational, global and networked (Castells, 2000c, p. 77). The "informational" aspect refers to the dependence on an ability to "generate, process and apply efficient knowledge-based information" (Castells, 2000c, p. 77). Furthermore it is highly dependent on, but not caused by, the information technology revolution. The "global" aspect refers to the organisation of production and consumption at a global scale. As an effect of this the "networked"-part refers to the way competition is played out in a global network of enterprises and to the interaction between businesses and business networks (Castells, 2000c, p. 77).

According to Castells, working in networks strengthens the innovative abilities of the individual participants (Castells, 2000c, p. 187). The networking logic enables us to solve different functions in a new and flexible way, without the Internet, the flexibility of many networks cannot be utilised. Organisations and communities with many weak but loosely coupled ties often have more links to other communities and networks and are therefore more flexible (Granovetter, 1973).

Given the three characteristics, informational, global and networked (Castells, 2000c, p. 77), the network economy is both an opportunity and a challenge to rural communities. Because of the informational and global nature of the economy, the location of the producers and consumer are not as important anymore; time and place become less relevant in some respects. Although for rural communities *place* does not lose its relevance, the focus need to changes to maintain the communities place in relation to the global economy. This requires access to sufficient infrastructures and a well-established innovation system that enables the community to retain a place in the informational and global economy. According to Urry (2003, p. 15) "both the global and the local are bound together through a dynamic irreversible relationship… Neither the global nor the local can exist without the other." Because changes are caused by changing international (global) conditions, the ability to identify opportunities and threats and act upon them is even harder than in the traditional economy, the threats are not as tangible (Stöhr, 1990). Though at the same time Urry claims

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that Castells and other writers leave the global as a 'black box' (Urry, 2003, p. ix) as a result there is little knowledge about what "sort of 'system' the global is" (Urry, 2003, p. ix). Leaving it as a black box limits our knowledge about the cause of the transformation of localities, regions, nation states and we need to know more about the working of these complex events and the actions needed to support such transformations. This thesis address this from a local perspective, though Latour (1999, p. 19) claim that "there is no zoom going from macro structures and micro interactions" both are " local effects … of circulating entities". Still my analysis starts with the local and rural aspects.

Although the economy is global, it is asymmetrically distributed, with the *traditional* Western countries driving the development.   Large areas and population groups are excluded, while simultaneously the development of the new economical paradigm is affecting all groups directly or indirectly (Castells, 2000c). This fundamental asymmetry affects an area's or group's level of integration, its competitiveness and its ability to benefit from economic growth. To avoid marginalisation it is particularly important for developing countries but also for rural areas in developed countries to stay abreast of the evolution of this new society. Traditionally the local community was the space that brought things together, "space of places" (Castells, 2000c, p.378, 453) that is, a place is a community that is self-contained. With the new network society, there are also emerging new spatial forms. Even if the specific community and organisations are place-based the organisational logic is placeless and dependent on flow and therefore belongs to the space of flow. For rural communities it is therefore a struggle in "the dialectical opposition between space of flows and space of places" (Castells, 2000c, p. 409), or a process of "simultaneous globalisation and localisation" (Castells, 2000c, p.458).

In the space of the network economy what ties the network together is transactions and communication between the nodes in the network, often called the flow of information (Castells, 2000c; Mosse & Sahay, 2001). This flow is include; "flows of capital, flows of information, flows of technology, flows of organisational interactions...and symbols" (Castells, 2000c, p. 442). Flows are an expression of the production processes that takes place. The word 'flow' might be somewhat misleading, but are also dependent on the purpose and operation of the network. The network can be supporting a work flow, then one actor need to finish the operation before the next can start, and the digitalisation of such a flow require "a lot of work and effort" (Moser, 2004, p.39). In more informal networks

such as those in my empirical material, where there is a less structured development process aiming to achieve a common aim. The interaction between the actors or flow in the network is therefore constituted by the exchange of information, in relation to activities and resources and the dependencies between them (Håkansson & Johanson, 1993). But independent of this the space of flows can be defined as a combination of three layers (Castells, 2000c, pp 412-15) these are:

- Technology: the infrastructure of the networks, computers physical transportation layer often based on information technologies
- Places: The topology of the space made up by its nodes and hubs – places with specific social, cultural, physical, and functional characteristics.
- People: the managerial and/or professionals who command the network

In a society characterised by space of flows, things that happen in one place immediately affect the outcome of things in other places. Further, it is characterised by the two concepts timeless time and placeless space. Timeless time is determined by things happening being simultaneously accessible globally (Stalder, 1998), and it is placeless because the organisational logic is placeless "being fundamentally dependent on the space of flows" (Castells, 2000c, pp. 169-170) and not on the local conditions and contexts. At the same time, communities and organisations are not placeless as they are influenced by the local social, cultural, physical, and functional specificities of a place. This is a challenge that rural communities have to address in their development work. Ulrich Beck also addresses these issues in relation to the Risk Society (Beck, 1992). In the risk society the basic social forms and principles of industrial society are challenged by global changes. The risk society influences all communities reflexively. This reflexivity represent a non-linear modernity, changes are a result of a combination of external and internal change forces, external through global networks and feedback loops and internal through feedback loops (Lash, 2003). The social communities have a choice of responding to these challenges, but the choice needs to be immediate, to make quick decisions to avoid falling too far behind in development. The kind of response in the community will influence the further development of the community through intended and unintended consequences.

3.1.2 Networks as a socio-technical development

Development of networks, flexible networks, is dependent on technological networks such as the Internet. The networks depend on the technological advances, not in a technological deterministic way, nor can they be attributed to social processes alone.   Technological determinism views social and cultural change as determined by technical forces (Bijker, Hughes, & Pinch, 1987). In other words, technological advances are the basis for both social and technological development. On the other hand, social constructivism sees knowledge as socially constructed and technology too as a social construct (Pinch & Bijker, 1984), i.e., everything in technology can be determined by social processes. In several places Castells have addressed this dichotomy (Castells, 1999a; 1999c; 2000a), as in the following;

> *"Technological determinism is in essence the negation of social theory. Thus, we must reject from the onset any attempt at placing technological change at the roots of historical change. Yet, it is as important to acknowledge the extraordinary social change represented by new information technologies (Castells, 1999a, p. 44).*

According to Castells social change is not a result of technical determinism or social constructivism, but a result of both social and technical influence, the social and technical development is inseparable "… technology does not determine society. Nor does society script the course of technological change … since technology is society, and society cannot be understood or represented without its technological tools" (Castells, 2000c, p. 5).

Summing up, networks are a socio-technical development where technology and the social context cannot be seen as separate, but rather as intertwined entities (Dahlbom, 1996; Kling, 2000). From this perspective, technology is not a force influencing society from the outside but an integral part of a social phenomenon (Castells, 2000c; Dahlbom, 1996; Kling, 2000; Skjervheim, 1996b).

This argument is also valid for the network society. Without the technological advances in ICT, networks would not be able to operate in the same flexible way and there would be no economic globalisation (Castells, 2000a, p. 111).

This development also influences rural areas. They need to embrace the informational aspect of the networks and to model the challenges facing them to their own conditions. One way to develop the informational aspects is through networking. For a rural

community, business networking can be a development strategy that enables further development. Castells argues:

> *"The most critical distinction in this organizational logic is to be or not to be – in the network. Be in the network, and you can share and, over time, increase your chances. Be out of the network, or become switched off, and your chances vanish since everything that counts is organized around a worldwide web of interacting networks" (Castells, 1999c, p. 6).*

To be part of a network require access to the right level of infrastructure and the capability to use it

3.1.3 Network Characteristics

A number of variables can be used to describe the basic structure of a network. First the topology of the network (Urry, 2003); the line or chain network with nodes spread out in a linear fashion; the hub or star network, where the nodes are connected through a central point; the all-channel network or the many to many network in which more or less all nodes are connected to all other nodes in the network.

Second, the ties in the network determine its vulnerability, a network with strongly/tightly coupled ties is less flexible and more prone to accidents than loosely coupled networks (Perrow, 1999; Urry, 2003). According to Perrow (1999) things happen faster in tightly coupled networks, and the consequence it is harder to isolate the a problem – the domino effect is greater. In the loosely coupled networks there is more flexibility and slack. They have the organisational capacity to handle unexpected incidents (Perrow, 1999) and there will always be errors since nothing can be perfect (Hansen, Høyer, & Tengström, 2000; Perrow, 1999).

Thirdly , another aspect of the ties in networks is whether they are weak or strong (Granovetter, 1973). This is somewhat similar to the strong/tight coupling but also covers other attributes relating to the flexibility of the network. Strong ties foster local cohesion, while weaker ties foster the ability to mobilise and act in concert. Seen in light of

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Granovetter's principle on "the Strength of Weak ties[6]" (Granovetter, 1973), networks, enterprises and individuals with weaker ties to other networks or individuals are more innovative and are able to change faster and co-ordinate activities better than closed networks. Strong ties are often a hinder to adoption of innovation. In communities' strong ties foster local cohesion, while weaker ties foster the ability to mobilise and act in concert.

Fourthly, networks operate differently depending on whether the communication and obligations in the network are mainly uni-directional or multi-directional.

Further networks "overlap and interconnect with other networks" (Urry, 2003, p. 52; 2005) or consist of "networks within networks" (Capra, 1996, p. 36). Networks with strong ties often have few connections to other networks, while networks with weak ties often have more connections to other networks (Granovetter, 1973).

3.1.4 Local Networks – Counter networks

Rural communities are scattered, fragmented and disconnected; they are influenced by social and cultural conditions. In the contemporary society these communities are exposed to global change processes, change processes which are highly dependent on space of flow, that is networks of information, education, production processes etc, but if the rural communities do not get connected to these networks they are at risk of being marginalised.

Given the influence, that the global networks have on rural communities and regions there is a need to understand how the dynamic relationship between global and local can operate together without one overpowering the other. Of course not all localities are participating in the global flow, the flow bypasses some communities while it connects other communities "along information and transportation rich 'tunnels'. These can compress the distance of time and space between some places while enlarging those between others" (Urry, 2003).

The global networks described above and their asymmetrical nature poses a challenge to rural communities. Some communities show no resistance when facing external challenges,

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[6] The strength of a tie is defined as "a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie" (Granovetter, 1973, p. 1361). A given tie can be classified as "Strong, weak and absent" (ibid).

they will soon fall out of the networks and experience inertias. Whereas in other communities the will to counter these processes is strong, and along with the counter process, a climate for innovation and entrepreneurship may grow. Such counter actions are often more successful than centrally driven processes because the local actors are better at identifying, mobilising and combining local resources (Stöhr, 1990). Castells sees the self organising nature of the networks as one of the strengths compared to centrally organised networks. A few key individuals usually initiate such local initiatives, but there is little that can be done without a connection to local social and institutional networks. In working through the network the initiator functions as an agent motivating different local actors to collaborate to face the common threat.

I use the term 'counter network' inspired by Castells (1997, pp. 72-81) on counter movements and defined by Mosse and Sahay who introduced the term counter-network in an effort to study "how otherwise marginalized groups and regions can be enrolled into socio-economic development processes enabled by ICT" (Mosse & Sahay, 2001, p. 79). Their study related to introduction of health information in Mozambique. The term counter is used to illustrate the process of countering a development not in the term of stopping it, but to reduce the divide. Castells use of the concept in relation to the Zapatista movement in Mexico (Castells, 1997, pp. 72-81; 1999b), to environmental movements, counter-cultural movements and human rights organisations (Castells, 1997, pp. 110-131), he refer to them as "counter-domination" (Castells, 2000a, p. 110).

What makes a network a counter network rather than a just a network? A counter-network is characterised by the actions that it carries out. The participants in a counter network have a common aim, relating to an external challenge, or an adversary. The challenges determine the actions needed to achieve the common goal this also give them a common identity, an "identity for resistance" (Castells, 1997, p. 9). This identity building process is "clearly defined by history, geography, or biology, making it easier to essentialize the boundaries of resistance" (Castells, 1997, p. 9).

The networks in my study are different then the Zapatista, but Castells network concept of counter-domination and identity of resistance are still relevant. The rural networks are established to ensure that the rural communities get the same opportunities and level of access as in more urban area, and to be able to keep a connection to the organisational logic

of space of flows. The counter network is established to attaining sufficient awareness about the challenge, it is critical how inhabitants, companies, and organisations mobilise their local network and react to such challenges. Furthermore, the way they co-operate and compete will influence their ability to develop efficient responses to the challenges (Amdam, 2000; Healey, Magalhaes, & Madanipour, 1999; Putnam, 1993; Stöhr, 1990). The challenges must be countered through strategies and tasks that adapt to the contextual situation and problems of the community (Stöhr, 1990). Depending on the context of the challenge, the community needs to mobilise either to restructure or to create an environment that encourages innovation. At any given point in time there are two types of networks that influence the development in a community; there are top-down networks posing global challenges to businesses and communities. And there are bottom-up networks, which have to counter the challenges posed by the global network, to be able to model the challenge to the local needs and context. As a result a number of micro and macro processes influence the situation. This is a process that affects the communities reflexively. The processes taking place include both learning and innovation.

3.1.5 Summary of concepts brought forward to the analysis

This section has discussed the challenges that the new organisational form dependent on networks pose in general and in rural areas. Further it has explored how local communities according to the literature can address these issues.

There are particularly four concepts that I want to draw on from this walkthrough, as summarised in Figure 6 below:

- *Complexity and couplings*: The concepts of complexity and couplings relates to the dichotomy describing the vulnerability and resilience of a network. A loosely coupled network with weak ties will be more resilient and less vulnerable than a tightly coupled network with many strong ties. Complexity increases with the strength of the couplings (tightly coupled and strong ties).
- *Reflexivity*: The concept of reflexivity adds to the complexity of the operation of the network. The network is simultaneously having to handle both internal, through feedback loops) and external change forces. As a response to these challenges choices needs to be made quickly to deal with the new situation. The choices made locally

also influence globally through feedback loops through systems of connection as a circulating entity.

- *Counter network*: The concept counter network is used to describe networks of action to counter a particular development, it is based on a common identity, an identity of resistance, a common aim and an adversary.
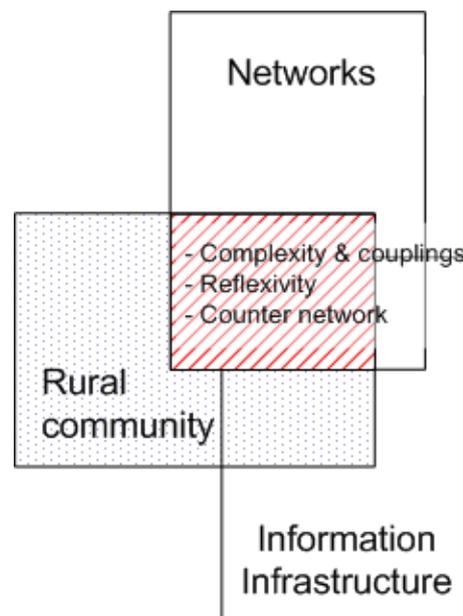
Figure 6 Network perspective and concepts and the rural community context

3.2 Regional Innovation Systems

While Castells primarily discusses innovations in networks at a macro or global level, I focus at a local and rural level: Studying the development of information infrastructures in a small-scale network between rural enterprises. This requires a coupling between Castells' work via counter networks, information systems development and diffusion and also regional development and innovation.

Innovation systems exist and are described in the literature on at least three different levels; regional, national and global, but also as sectorial innovations systems (Asheim & Isaksen, 1997a; Lundvall, 1992b; Smith, 1997). Whereas the national systems of innovation assume that the nation state is the foundation for the innovation system (Lundvall, 1992b), others see the global, i.e. global networks where multinational companies work together and bypass the relations to the nation states in which they are located (Castells, 2000c; Lundvall,

1992b). Again, other researchers place emphasis on the importance of the regional innovation system (Asheim & Isaksen, 1997a; Storper, 1997). The coexistence of all levels and the symbioses between them are important to ensure further development. In the following, I will focus on the regional level but also draw on the other levels.

The regional innovation system is the core component to strengthen the development of a region. The innovation system is a social and dynamic system that allows for the flexibility needed in innovation processes. Important inputs in an innovation system are knowledge recourses and learning processes (Lundvall, 1992b). The regional innovation system is often characterised by learning as part of interactive processes between organisations in the so called triple helix; government, industry, and universities and research (Asheim & Isaksen, 1997a; Leydesdorff & Etzkowitz, 2001). The regional innovation system must support the establishment of regional clusters, organisations or networks to be effective. Enterprises must be able to participate in activities that support their innovative capacity. Meeting places and network activities are a prerequisite for knowledge development and diffusion of ideas, technology and improved production or business processes (Cooke, 1998) and are needed to strengthen the innovation capacity of enterprises.

This section has three parts, it first innovation and institutional capacity, the next section looks at the socio-technical aspect of the innovation system. The third section concluded by summing up concepts that will be used later in the discussion.

3.2.1 Interactive innovation and institutional capacity

For a long time the linear innovation and diffusion model dominated but many have found to be too simple (Lundvall, 1992b; Malecki, 1991; Rogers, 1995). The linear model is comprised of four sequential steps as illustrated in Figure 7.
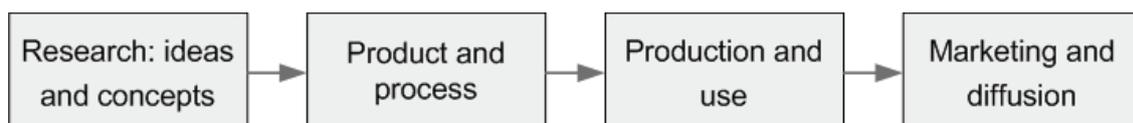
Figure 7 The linear innovation model

The linear model does not support communication between the specialised and distinct stages (Jansen, 1998; Rogers, 1995). Smith points out that the linear innovation model overemphasises research (especially basic research) as the source of new technologies and has "a technocratic view of innovation as a purely technical act: the production of new technical devices" (Smith, 1994b, p. 2). According to the critiques of the linear model the innovation process cannot be reduced to these two dimensions, rather the innovative process is influenced by a number of different dimensions, both at micro and more aggregated levels. The more complex innovation model was termed the regional innovation system (Asheim & Isaksen, 1997b; Edquist, 1997; Lundvall, 1992b; Smith, 1997).

The main characteristics of the regional innovation systems, learning and innovation are defined through evolutionary research in the fields of regional economics (Morgan, 1997), and include both individual and collective innovations. Collective innovations are the interactive processes that in addition to the company itself also include the surrounding networks as part of the processes. To stimulate the innovative processes both R&D organisations and formal and informal social networks plays a role in strengthening the innovation capacity of enterprises (Asheim & Isaksen, 1997b; Cooke, 1998; Leydesdorff & Etzkowitz, 2001; Lundvall, 1992b; Smith, 1997). Gregersen and Johnson (1997) shows that the innovative capacity of enterprises is highly dependent on their networks.

In the rural setting local resources are vital for the innovations taking place as part of the innovation process. Typically available resources in a community are; intellectual, social, cultural and institutional capital (Bourdieu, 2001; Healey et al., 1999; Putnam, 1993). Social capital (Putnam, 1993) represents "an archive" of knowledge, institutional flexibility and trust. Healey et al. (1999) use the term "institutional capacity" to refer to a combination of knowledge resources, relational resources and mobilisation capability in a community. 'Institutional' here refers to the modern understanding of the term, where institutions are organisations, networks or structures where the participants have something in common, a common set of values, a common aim. Institutional capacity is something that a community can have, but it is also something that can be built or developed over time. One of the challenges that need to be further addressed is how to develop the institutional capacity along the three dimensions. Development of knowledge resources is related to access to and use of a rich range of knowledge, shared among those involved, and continuously developed through introduction and invention of new ideas, and the renewal of established ones. The

relational resources refer to the different existing networks in a community. These networks may need to be restructured to suit the current purpose. The relational resources need to be developed to a broad web of relations involving different stakeholders and must be an open rather then closed network with a number of bonds that bind actors to the network. The ability to enlist and interest actors and to keep them interested over time is important for the outcome of such processes. A clear web-like pattern with clear nodal points is a benefit, because it allows access from as many points as possible.

The availability of knowledge and relational resources are preconditions to developing sustainable institutional capacity. These resources also need to be deliberately mobilised to release their potential. Opportunities, arenas, mobilisation techniques and change agents are needed in such processes (Amdam & Veggeland, 1998; Healey et al., 1999). The development depends on the community and its actors' ability to develop and make use of the 'institutional capital'. The ability of the community to utilise this capital determines its development, Table 5 below outlines the possible outcomes when exploring a community's willingness and ability to break away form the path dependent development.

Table 5 Outcome of the interaction between institutional capacity and external pressure (inspired from Healey et al. (1999))

	Weak local capacity (unbalance in knowledge and relational resources and mobilisation capability)	**Strong local capacity (Balance in knowledge and relational resources and mobilisation capability)**
Local Closure (Not open to change as a result of external pressure)	Evolutionary trajectory (path dependent development)	Inertia – Are not open to deal with external change forces. Use their local capacity to avoid development as a result of the external pressure
Local openness (open to change as a result of external pressure)	Fragmentation – There is no local milieu for dealing with external pressure collectively. The technology prone to adapt to the changes while the general community falls behind.	Local modelling of external pressure – Have and know to utilise the local institutional capacity to deal with external pressure and to model changes to the local needs.

Healey et al. (1999) offers a framework that looks at the interaction between external pressure and local institutional capacities (knowledge and relational resources and mobilisation capability). Healey examines the factors that may enable a region to make a departure from the path dependent trajectory. The three components knowledge, relational resources and mobilisation capability need to be utilised to alter the path-dependent

trajectory. Healey et al. (1999) identifies four qualities for each component these are listed in Table 6.

The process described by the twelve qualities (Healey, 1997) is one of mapping resources and creating alliances between available resources, knowledge, stakeholders, networks etc and to create alliances across these special interest groups and ethnical divides in order to face the challenge together. 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, inhabitants and businesses are better equipped to transform the external challenges to their community's advantage.

Table 6 Overview over components and qualities (Inspiered from Healey et al., 1999)

Components	Qualities	Description
Knowledge Resources	Range	Knowledge map of the partnership. What is available of relevant knowledge such as scientific, analytical, technical, craft-based, commonsense knowledge
	Frames	Reference frames: The underlying conceptions influencing the interpretations of the challenge
	Integration	Degree of integration between range and frames; are they interlinked or disparate; are attempts done to translate knowledge and frames of reference to another
	Openness and learning	Ability and willingness to search for and absorb new ideas
Relational resources	Range	Stakeholder map: Who are the key actors, how do they relate to the potential stakeholders
	Morphology	Architecture of network and the linkages between different networks. Network density, weak or strong ties, loosely coupled or strongly/tightly coupled networks
	Network integration	Degree of integration between different local networks
	Power relations	What power relations keep the network together? "power to act" and "power over others"
Mobilisation capacity	Opportunity structures	Opportunity map – opportunities, constraints and desirable outcomes on the institutional change
	Arenas	What is the focus of the mobilisation efforts? How can stakeholders take advantage of the opportunities?
	Repertoires	What is the array of mobilisation techniques?
	Change agents	Persons critical for the mobilisation effort?

3.2.2 Innovation system as a socio-technical development

Innovation is often seen as synonymous with technological development. New and improved technologies have been the driving force behind industrial and development and

in society in general. Given such a perspective regarding technological development and innovation, society cannot influence the development but has to adapt as best possible to the changing conditions. According to Smith and Marx (1994) this perspective regarding the driving force of technological development can be traced back to early in the industrial revolution (Jansen, 1998).

This technological deterministic view is the basis for the linear innovation model (see Figure 7) (Smith, 1994b). In this model, research is the basis for innovation. It is technocratic in the sense that innovation is seen as the development of new technical devices and it is sequential with no or little communication between the different stages.

Contrasting this is the social constructivist view, a perspective developed in the field of sociology, which perceives technological innovations as a result of social conditions and change forces. One such tradition "Social construction of technology (SCOT)" (Smith & Marx, 1994) claims that technological systems can be developed to the needs of users and organisations without any consideration to the specifics of the technology available. The main critique of SCOT was related to this view of technology as a black box.

Actor network theory (ANT) (Bijker et al., 1987; Latour, 1987) avoids the dualism constituted by constructivism and technological determinism, by focusing on the processes involved in developing socio-technical networks (Cordella & Shaikh, 2006). ANT considered social and technological components as equal and developed as a result of the influence from a number of actors. The social-constructivist perspective underpins much of the innovation system literature and focus on "how, in particular contexts, or 'opportunity spaces', institutional capacities are embodied in the thinking and acting practices of those in institutional re-design situations" (Healey et al., 1999, p. 123). Further technology is not considered part of the community but as an external challenge that needs to be dealt with.

The current development is one away from the deterministic linear innovation process (Asheim & Isaksen, 1997a, p. 303; Felsenstein, 1994, p. 73) to a non-linear evolutionary theory of economic and social change. Underlying this is an understanding of technology as both a technical and social process and the understanding that innovation is not a directional linear process but the result of a interactive process between the innovator and its surrounding social and technical environment (Smith, 1994a).

Storper (1997, p.28) sees technology as a distinct actor in the regional innovation system (Figure 8). Technology is seen as a third player in addition to territories (spatial regions) and organisations. In such a structure, technological change is recognised as one of the drivers in changing spatial patterns of economic development. In addition, the organisations are not only dependent on spatial contexts of physical and intangible inputs, they also have greater or lesser proximity to each other. The innovative activity is seen as a local and regional phenomenon that represents a new theoretical understanding of how the innovation processes occurs. This is an understanding that is made concrete in the interactive innovation model (Asheim & Isaksen, 1997a; Isaksen, 2000), which defines innovations as interactive, non-linear knowledge development and transfer: technology and knowledge flows freely between R&D activities, the industry and other stakeholders. The innovative activity is seen as both social and technological processes related to development of trust, social networks and "social capital".
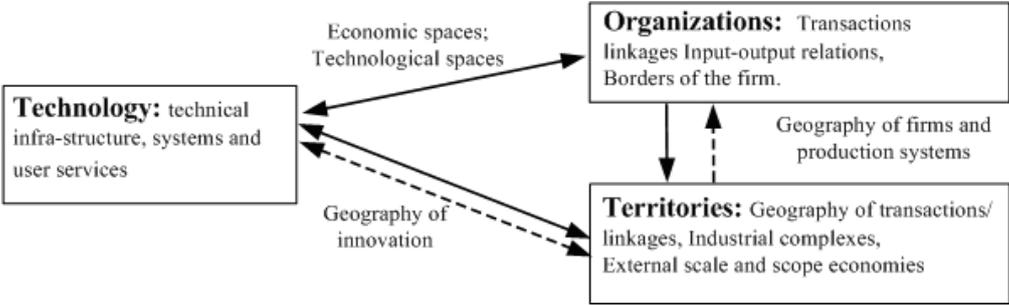
Figure 8 The 'holy trinity' Technologies- organisations-territories, modified from
(Storper, 1997, p.28)

3.2.3 Summary of concepts brought forward to the analysis

This section has discussed the concept relating to the regional innovation system in relation to development in rural area, four concepts have been identified for use later in the discussions. Figure 9 (next page) illustrate the additional area.

There are particularly four concepts that I want to draw on from this walkthrough:

- *Knowledge resources*: The concepts knowledge resource refers to relevant knowledge for the challenge(s) addressed, and the willingness to address new ideas and make change possible.

- *Relational resources*: Starting with the key actors, it will often be necessary to extend the network, making an overview over potential components, actors or stakeholders and neighbouring networks. In counter networks finding the stakeholders that may help develop the counter actions. Considering integration / collaboration with different local networks to pool resources.
- *Mobilisation*: The concept of mobilisation is important to get the network operational. Identifying opportunities, constraints and desirable outcome for first adapters. This is defining the development process
- *Institutional capacity*: The concept of institutional capacity is the sum of the three above. Institutional capacity tells something about the ability to handle change forces, respond to them and carry the processes of modelling it to local needs and conditions.
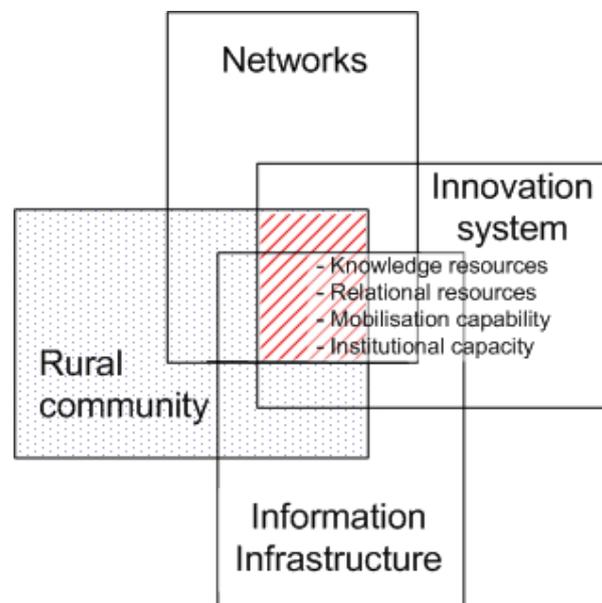
Figure 9 Regional innovation system concepts in relation to the rural context

3.3 Synthesis of concepts

The interrelationship between the three perspectives; network, infrastructure and innovation system, and the concepts identified in this area have individually and together provided insight to the study of rural development processes in an effort to identify factors contributing to uptake and development of ICT in rural area. It has also enabled me to analyse the dynamics which enable local adaptation of global challenges in context of ICT and information systems. The initial research framework is illustrated in Figure 1 (page 3).

Figure 10 below illustrates the interrelationship between the three perspectives and the rural community context. The three areas provide different perspectives but complementary insight to the research topic. The notion of networks and flow draw attention to the prevailing organisational logic, one of the challenges that rural communities have to keep up to. Rural communities have a relative short time to get up to speed, the extent of the organisational logic is growing and the reflexivity of change processes adds to the complexity a network have to deal with. The notion of counter network offers one such organisational logic that rural communities can use, and which utilises the logic itself to improve own conditions.
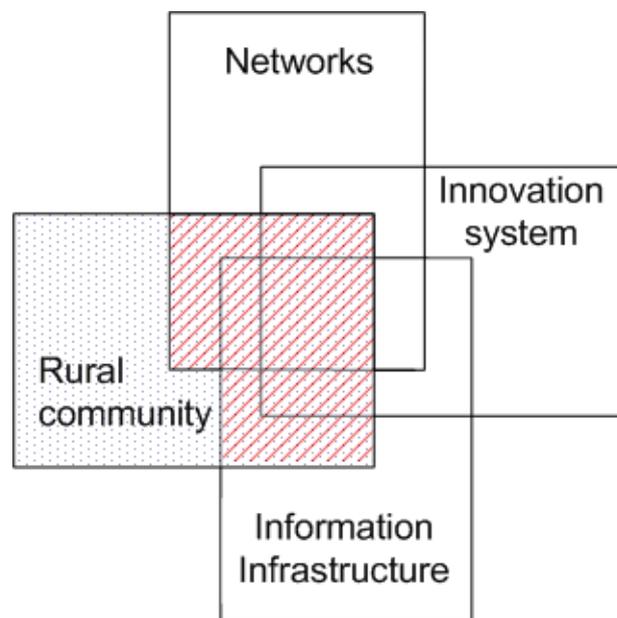
Figure 10 Interrelationship between the three theoretical perspectives and the rural context

The basis for the information society is the continuously increasing use and dependency on information's and communication technology. In an attempt to not be bypassed by the information society access to and use of these tools are necessary. For rural area access to sufficient telecom infrastructure, is one challenge and access to the competence and skills to utilise the technology may be another challenge, and when such access is not available a local initiatives, a counter network, may be able to make the change possible. Latour (Latour, 1987) use the two terms; 'translation' and 'diffusion' to describe the innovation processes. The term 'translation' is used to describe the innovative processes leading up to a stable product or fact. In other words, it encompasses the actions needed to enlist and interest human and non-human actors in the network developing an innovative product. When these actions are successful, there is no way around the implementation and diffusion

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of the artefact. The term 'diffusion' then describes the actions and strategies needed to diffuse the artefact. In the 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 market economy is true until a certain point, until it is diffused to the areas filling the criteria's of the market economy. In more remote areas which do not get the service based on a diffusion model, it is necessary to take a step back and re-enter a translation model, to enlist and interest human and non-human actors in a network, a counter network, to "reinvent" the scarce resource fitted to the local conditions. In initiating such a network it is important to explore the installed base to identify what exists and can be cultivated as part of the process. To get to know the installed base both the human and technical aspects need to be explored.

Innovation systems are structures usually addressed at nation or region level, but initiatives are local counter networks in a rural region it is also necessary to address the innovation system at a rural level – the rural innovation system. What separates a rural innovation system from the other levels is access to resources in particular knowledge resources, which make it necessary to think in a different way. Few people live in rural areas, in addition there is often a net out migration, young and educated persons move from the area. The number of educated compared to number of inhabitants is often low. Often the same persons become involved in many initiatives. When initiating initiatives it is therefore important to identify the available knowledge and relational resources to be able to involve the appropriate knowledge from within the community, if possible. If not possible then it is necessary to seek such from outside by utilising the networks available identified as part of the relational resources.

Integrating the three theoretical perspectives (Figure 10), but zooming in on the rural context and the theoretical concepts of relevance to rural area (the shaded area common between the different perspective), with the initial research framework (Figure 1, page 3) this illustrate the interest in this thesis (Figure 11), below. In this figure I have chosen to illustrate the limitations of the thesis by placing the three theoretical perspectives inside the rural community box.
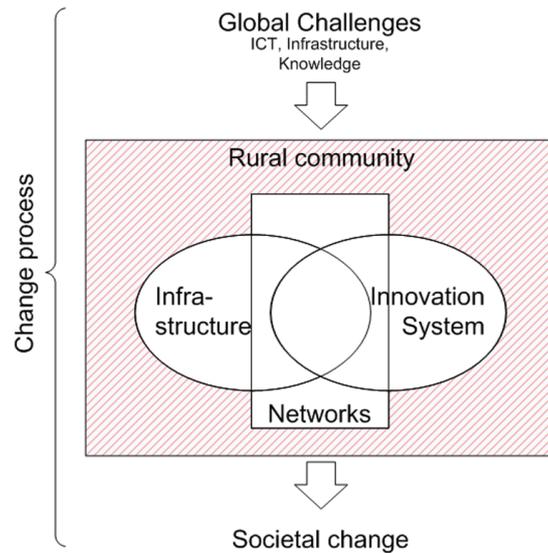
Figure 11 Theoretical perspectives zoomed to area of interest

In summary by studying the three theoretical perspectives eleven concepts have been identified as important for rural adaptation of ICT challenges from either the related research or the theoretical perspectives, these are; top-down approach, bottom-up approach, installed base, cultivation, complexity and couplings, reflexivity, counter network, knowledge resources, relational resources, mobilisation, institutional capacity. These concepts will from the basis for identifying factors and local adaptations of global challenges in relation to information and communication technology.

4. Research Findings

4.1 Overview

This thesis draws upon six papers published in conference proceedings, journals and as book chapters. The papers are from different stages of the doctoral study and are written together with different authors and for different outlets. The order of presentation is not chronological but based on the three different studies. The complete references to the papers are as follows:

1) Skogseid, I. & Jansen, A. (2001) Booktowns on the Internet: Rural Enterprises Enter the Network Society. Published in the Proceedings of the International Conference on Information Systems, New Orleans, Louisiana USA 16.-19. December 2001

2) Jansen, A., & Skogseid, I. (2003) Book towns and the network society: new perspectives on developing rural enterprise. Published in S. Krishna & S. Madon (Eds.), The Digital Challenge: Information Technology in the Developing Context. Ashgate Publishing [7]

3) Gripenberg, P., Skogseid, I., Botto, F., Silli, A., & Tuunainen, V. K. (2004). Entering the European Information Society: Four rural development projects. *The Information Society*, 20(1).

4) Skogseid, I. & Strand G. L. (2003) Bottom-up Initiatives' Role in Technological Regional Development. In Riukulehto S. (Ed.) New Technologies and Regional Development. University of Helsinki, Seinäjoki

5) Skogseid, I. & Hanseth, O., (2005). Local Actors Build Broadband Infrastructure. In proceeding of the European Conference on Information Systems, Regensburg, DE, 26-28 May 2005

6) Skogseid I. (2007) Improving Broadband Access in Rural Areas. In Handbook of Research in Global Diffusion of Broadband Data Transmission, Dwivedi Y.K., Papazafeiropoulou, A., and Choudrie, J. (Eds). IGI Global, Hershey, PA, USA.

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[7] This paper was first published at IFIP WG9.4 Conference: ICTs and Development : New Opportunities, Perspectives and Challenges in Bangalore India 2002 (Jansen & Skogseid, 2002)

Below is a synthesis of the included papers. The synthesis explores the findings of the papers and their contribution to the broader research questions posed by the thesis. The two first papers address the BookTownNet study, the third paper is a comparative study of four projects funded by the European Union and the three last papers address broadband development in rural areas.

4.2 Paper 1: Booktowns on Internet - Rural enterprises enter the Network Society.

The first paper (Skogseid & Jansen, 2001) relates to the broader debate on ICT diffusion and adoption, particularly within a local rural context. The paper explores the BookTown.Net case using a framework that draws on a combination of theories from information system research and regional economics in analysing the development and diffusion of information and ICT to small, rural enterprises organised in a network. The framework describes the regional innovations system and infrastructure. Furthermore, it identifies components contributing to the development, which to some degree can be compensated by resources in the network.
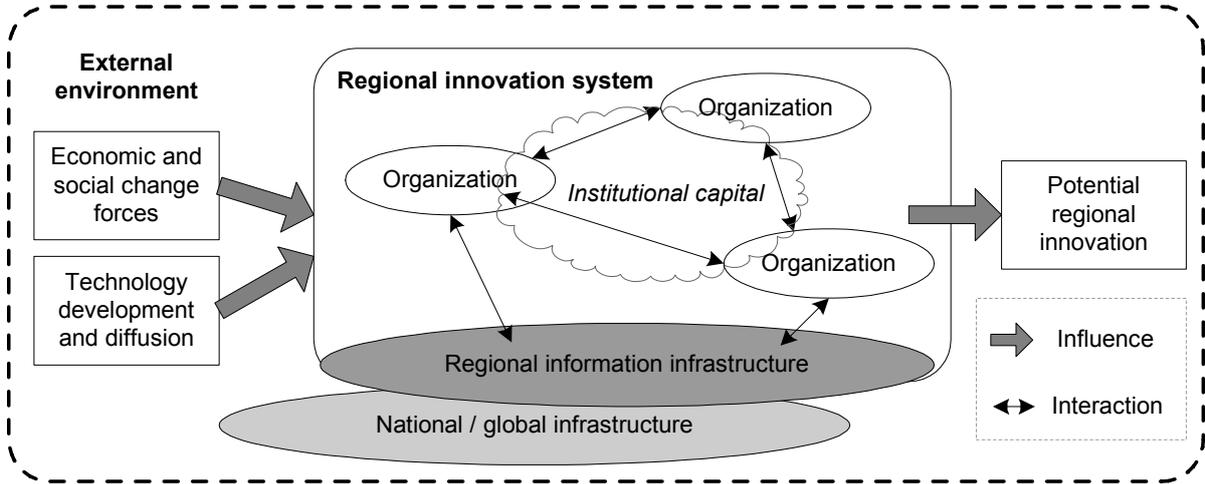
Figure 12 Framework that model regional innovation system with regard to technological development

The findings indicate that use of internet tools both locally and between the book towns strengthened the communication and collaboration between booksellers and the towns, thus

providing a better basis for the small bookshops to be competitive in the information society. Differences in local innovation systems have partly influenced the diffusion processes. The data also show that the book-town network has been able to compensate for the lack of support in the regional innovation system. This testifies to the important role of the ICT -based virtual network in spanning geographically distributed communities. It indicates that the book-town infrastructure and support system has been the most essential factor in the bookshops' capabilities for implementing and using the new technical solutions.

Key concepts: Institutional capacity, relational and knowledge resources, mobilisation capability

Key findings:

- Explored the role of ICT in establishment and growth of the network between book sellers and book-towns.

- Small rural businesses and organisations were able to utilise Internet to establish and strengthen the institutional capacity of the individual participant, in the community and in the network.

- The participants in the project became more advanced users of ICT, some had some experience while other started using computers in relation to this initiative

- The participants were able to utilise ICT to communicate and collaborate between themselves independent of geographical locations.

- The network has been able to compensate for the lack of support in the regional innovation system, which highlight the importance of ICT-based networks spanning geographical distances and different rural settings

4.3 Paper 2: Book towns and the network society: new perspectives on developing rural enterprise

This paper (Jansen & Skogseid, 2003) explored the response of small rural enterprises and communities to the challenges posed by a new global economy. How can a local community rise to meet the challenge of the network society? Use of technology to improve efficiency in production created a new mode of development. As a result, economic activities must be restructured into a new mode of production based on access to information and the

capability of processing it. This is a challenge for small rural enterprises and communities with a net out migration of young, educated people. Often these communities fall behind when it comes to use of ICT and sufficient communication infrastructure.

The new global economy is asymmetrical; not only are there differences between north and south, east and west, but also within and between urban and rural areas. This move from Castells' (2000b; 2000c) a macro-level to a micro-level analysis alters the questions that need to be asked; what can actors in these less developed areas do to improve their conditions?

The BookTownNet project is the empirical basis for the paper. The network established through the project has been important for the implementation and use of ICT. The communities that have taken a most proactive role in the development of the network have mobilised their local resources to use new technology and to take active part in the network. The findings are relevant for similar efforts to build networks between small enterprises in a rural setting. It is possible to stimulate local economies through collaboration in horizontal networks. The local innovation system plays a significant role in this endeavour as a support system for the initiatives. There needs to be interplay between the common infrastructure and innovation system.

Key concepts: institutional capacity, relational resources, counter network
Key findings:
- Small horizontal networks between small rural businesses can create a sufficient institutional capacity to break away from a path dependent trajectory and model the global challenge to their own needs.
- There are different types of relations in the network— most notably between the actors who take an active part in the process and those who are more passive regarding changes, even when these are carried out in relation to them, this affects the uptake of ICT by specific organisations but also affect the local network.

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4.4 Paper 3: Entering the European Information Society: Four Rural Development Projects

This paper (Gripenberg et al., 2004) compares four European ICT development projects that all contribute to the development of the European information society. The projects all sought to support learning and better use of ICT in disadvantaged groups, e.g. located in rural communities, to help bring them into the information age. The paper draws on theories relating to the social construction and mobilisation of networks and technologies. The analysis includes theories relating to virtual work and ICT-supported networking.

The four projects all resulted from opportunities opened up by political initiatives. The analysis identifies the opportunity, motivation/initiation, transformations, and actors and roles in the projects. Critical issues and concerns relating to the projects are addressed. The paper compares the four projects with types of network characteristics, discontinuities, continuities and possible problem areas identified in the literature. It also lists additional continuities and discontinuities identified in the cases.

The analysis indicates that the main problems afflicting these projects stem from varied expectations and interests of the major actors. These problems can be mitigated considerably if a feeling of ownership is generated among the participants. This sense of belonging, however, is difficult to foster in a "top-down" project. Hence, we need better balance between the "top-down" and "bottom-up" influences in the development of such projects.

Table 7 Issues related to the relations between actors in an information society projects

Relation	Issues identified in the four cases
Initiator–facilitator	Expectations about project outcomes
Facilitator–community	Expectations about ICT skills knowledge and development
Initiator–community	Expectations about initial ICT skills and project motivation
Technology–community	ICT skills; expectations about technology
Facilitator–technology	Expectations and knowledge about technology
Initiator–technology	Expectations and knowledge about technology

<u>Key concepts</u>: mobilisation, institutional capacity, top-down, bottom-up

<u>Key findings</u>:

- The actors in the network have different roles and they might have different skills and expectations', the relation between the different roles can influence the operation and outcome of the initiative. The roles identified are: initiators, facilitator and community and technology.

- Even if the implementation of the technology has been straightforward there is a need for negotiations and understanding between the actors to mobilise the actors at different stages in the project

- The paper identifies a number of network characteristics, continuities, discontinuities and possible problem areas, from the literature and some new were identified in the cases. In relation to the BookTownNet case the following were identified as most relevant

  - Identified network characteristics: Virtual supply chain and Virtual enterprises
  - Identified discontinuities: physical, temporal and geographical location, language, functional, regional, national and organisational culture
  - Identified continuities: shared motivation and goal, shared media and practice, and incentives
  - Identified problem areas: Lack of technical support personnel, initially lack of clear objective and understanding of shared information, lack of local problem-solving focus and other technology-related problems. In addition the participants were insecure of how to act in an ICT supported environment.

- This kind of community projects need to have a balance between top-down influence and bottom-up processes to achieve the aim.

4.5 Paper 4: Bottom-up Initiatives' Role in Technological Regional Development.

This paper (Skogseid & Strand, 2003) discusses rural broadband diffusion in relation to an understanding of the regional innovation system (Figure 12). Explored how two communities have met the external challenges and used institutional capital to build up an infrastructure and a support system to strengthen the community. In particular how have

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they been able to utilise the institutional capital in the community to locally model the external change forces (Healey et al., 1999, p. 123).

The paper explores key factors contributing to the development of two local broadband initiatives. The two cases examined differ contextually and have different types of actors. The paper explores the actors and the role they have in the bottom-up initiative. There are differences in motivation and driving force, whereas the challenges are the same.

The cases show that it pays to make an effort and those external forces of change can be modelled by working together in a community and utilising available institutional capital and infrastructure. Each local initiative will face a different set of challenges dependent on the local context, available knowledge and relational resources and their mobilisation capabilities (Healey et al., 1999) available.

Key concepts: institutional capacity, knowledge and relational resources and mobilisation, bottom-up development

Key findings:

- The utilisation of knowledge and relational resource and mobilisation capability in the local community was identifies as a core factor for the development and uptake of the initiatives.
- The actors taking part in the development had different roles
  - o Public sector; involvement of public sector gave access to funding, in addition they were demanding customer in the initiatives. In part he installed base was owned by public sector organisations
  - o Research and education; involvement of research and education organisations gave access to knowledge about setting up and operating the infrastructure. In part he installed base was owned by an educational organisation
  - o Private sector; Private sector were demanding customer and service providers. In part he installed base was owned by private sector organisations

4.6 Paper 5: Local Actors Build Broadband Infrastructure

This paper (Skogseid & Hanseth, 2005) explores the process of establishing heterogeneous networks consisting of both technical and organisational actors. An interpretative research approach helps to understand the process; "how" and "why" (Yin, 2003) things happened and provides insight about the unfolding of the development. This approach takes both socio-technical and socio-cultural aspects of the construction into consideration, whereas focus is on the subjective processes surrounding the social construction of the network (Walsham, 1993).

The 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. Individuals, businesses and public sector in several rural communities have joined forces to bridge the broadband divide and have taken initiatives to develop and operate local broadband infrastructures. Each initiative faces a different set of challenges depending on the local context.

The paper open 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 market forces do not apply. We use two local initiatives as an example to illustrate how communities can assemble rural broadband access. These initiatives have used a bottom-up strategy involving local knowledge and relational resources and installed base to gain access, in contrast to the traditional roll-out of telecom infrastructure. Vital factors for the development are summarised in the table below.

A market-driven establishment of broadband infrastructure in rural areas needs to consider local specifications, rather than copying the top-down approaches used when developing traditional telecom infrastructure. Such considerations include the needs of potential first adopters, existing infrastructure (installed base) to build upon, local organisations that can take the responsibility of being a service provider (network operator), etc.

Pooling of resources (institutional capital) and collaboration in line with Healey's theory are necessary to build successful infrastructures in rural areas. If a closer collaboration between these two initiatives were the case, then there would be more focus on replication of

solutions or focusing on building one uniform standardised infrastructure. Traditional telecom infrastructures are built this way. Such a strategy would be less focused on coming up with 'quick (and dirty)' solutions where existing infrastructure was utilised 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.

Table 8 Important factors contributing to the two developments.

	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
1st adopters	Public sector (number of accesses) + private companies (quantity of data transferred)	Delivery of services between connected enterprises and an Internet based Digital images

<u>Key concepts</u>: cultivation, installed base, bottom-up development, institutional capacity

<u>Key findings</u>:

- A number of important factors contributing to the two developments were identified:
  - The strategy chosen, the actors involved, access to knowledge resources, the economy of the project, the motivation behind the initiative, the availability of a useful installed base and the first adopters.
- In such bottom-up initiatives there is a need to take the local specificities into account, the geographical location, the available installed base, including knowledge and relational resources that can be cultivated in the initiative.
- By pooling resources it was possible to get a much better infrastructure at a lower cost then would have been possible for individual organisations. It also created a balanced development in that not only the big organisations got access but in a way that also small enterprises could benefit from the initiative. At the same time the local specificities makes collaboration between the different initiatives less productive. It will not be possible to make a blueprint of one installation to another site. Knowledge and relational resources and mobilisation techniques can be shared but not needs to be adjusted to the local characteristics and installed base.

4.7 Paper 6: Improving Broadband Access in Rural Areas

This paper (Skogseid, 2007) explores the characteristics of rural broadband infrastructure development. Considering the existing installed base, small rural communities can initiate bottom-up cultivation of broadband infrastructure. Such initiatives are important contributions for overcoming the broadband divide. In effect, this approach aggregates the demand by creating a larger total market for suppliers than the individual needs of the actors.

The paper explores the installed base and its cultivation using descriptive clusters. A set of questions are defined to uncover the installed base. These can be used to get an overview of the types of resources available and the choices that need to be taken. The use of descriptive clusters puts emphasis on the local context and culture.

The descriptive clusters defined by Schön (1991) are intended to aid the design process, guide the development in the same way as Hanseth and Lyytinen's (2006) framework

information infrastructure. The cases have been described in retrospect to examine the development. A probe of the information brought forward in the description and supplemented by the previous description of the cases enables us to derive a number of questions that could have been useful to consider when starting a bottom-up process. In the planning process, the descriptive clusters can be used as a clue to describe the initial installed base and the considerations needed to further cultivate it. The descriptive clusters become rhetorical questions used to uncover the installed base and the "what if" and "if … then …" considerations needed by the cultivation process that identifies the opportunity space of the local development. As in all cultivation processes there will still be uncertainties. To reduce the uncertainties it is necessary to know as much as possible about local conditions and potential actors that the project should be aligned with, as well as the installed base; which components need to be added to the installed base as part of the cultivation must also be carefully considered. In Table 9 below, the descriptive clusters has been redefined to the broadband domain as a set of questions addressing key contributors in a bottom-up cultivation of the infrastructure. As such, it can also be used as a tool in the planning of a new development.

The questions defined for the clusters are "what" and "how" kinds of questions, the answers to these questions are this is the basis for the "what if" and "if … then …" considerations needed as part of the cultivation process for identifying the opportunity space of the rural development.

Using a bottom-up strategy is more complex, than a top-down rollout. One way for uncovering the starting point of a development involves the use of the descriptive clusters. The questions and answers describe important input to the development process, and by using them it is possible to get an overview over the kinds of resources that are available, the installed base, and the kinds of choices that needs to be taken. In addition, the use of a tool like the descriptive clusters puts a focus on the local context and culture in the community. With a bottom-up strategy, the questions have to be answered in relation to the local context, and when moving from one location to another there are things to be learned, but it be impossible to make blueprint implementations.

Table 9 Redefinition of descriptive clusters for the infrastructure domain, (modified from Schön (1991))

Cluster	Important questions to ask
Character	*Kind of infrastructure.* What kind of infrastructure is intended?
Use and function	*Description of intended function and use of the infrastructure* What is the intended function? What is the intended use? Who are the intended users? (Public sector/ business/ private)
Siting	*Descriptions of the site(s) to be served by the infrastructure. If relevant, description of neighbouring infrastructure, of geography or structural features that can influence the infrastructure and of organisations or actors that can play a role in bootstrapping the infrastructure.* Where is the installation? Location of sites to connect? What is the installed base? What organisational infrastructure can be utilised? Is there sufficient knowledge and competence to operate infrastructure? Who has this knowledge and competence? Who are the first adapters? Are there other potential first adapters that are instrumental to be included? Which facilities need to be connected to the new infrastructure? What are potential growth paths? Who are potential second adapters?
Precedent	*Models for the implementation, reference types.* Has anyone done something similar before? Is it possible to learn from them and their choices? Study trip?
Technology, building elements and components	*List of possible components. Design principles for development.* Which components is it possible to utilise? Hardware (Fibre, licensed and unlicensed radio, copper phone lines…, DSL). Standards, switches, organisation. Structure and basic choice of technology and development process.
Scale	*Reach and capacity of infrastructure, bandwidth, coverage %, coverage geography.* What bandwidth is needed? What is the geographical coverage? What is the percent coverage?
Form/ Organisation of space	*The shape of the infrastructure, distribution, redundancy, M:M or 1:M How and where is different places that will be using the infrastructure located, how can they be connected.* Possible designs taking technology, building elements and components, scale and costs into consideration. Should there be redundancy in the system? If this is the case how and where are the critical applications / users?
Cost of development	*Budget available for the development and for operations.* Cost of alternatives? Can the development be phased? What human resources are needed? Is there access to these resources? How can the project be funded? (Public funding, first adapters, dependent on critical mass of users.) Budget available for the development and for operations?
Representation	*Representation used to describe infrastructure.*
Explanation	*Protocol for frequency and Involvement of users in the development process.*

Key concepts: descriptive clusters, installed base, cultivation, top-down vs. bottom-up development

Key findings:

- A set of descriptive clusters in the form of rhetorical questions have been defined, these can be used to unveil the installed base

- The descriptive clusters can be a way to reduce the uncertainty in that it is addressing important factors in the development and …

- This gives a better understanding of local factors that may influence a process early on in the cultivation process.

- The descriptive clusters can be used as a tool to in planning new developments

5. Discussion and Conclusion: ICT and Rural Innovation Systems

This chapter starts with a discussion of the input from the different theoretical perspectives in an effort to address the aim of the thesis. The chapter goes on to summarise the findings of the thesis and map the areas covered by the two cases to the research area. This chapter draws on the related research, on the findings in chapter 3, Key theoretical perspectives, and on chapter 4, Research findings, as illustrated in Figure 13.
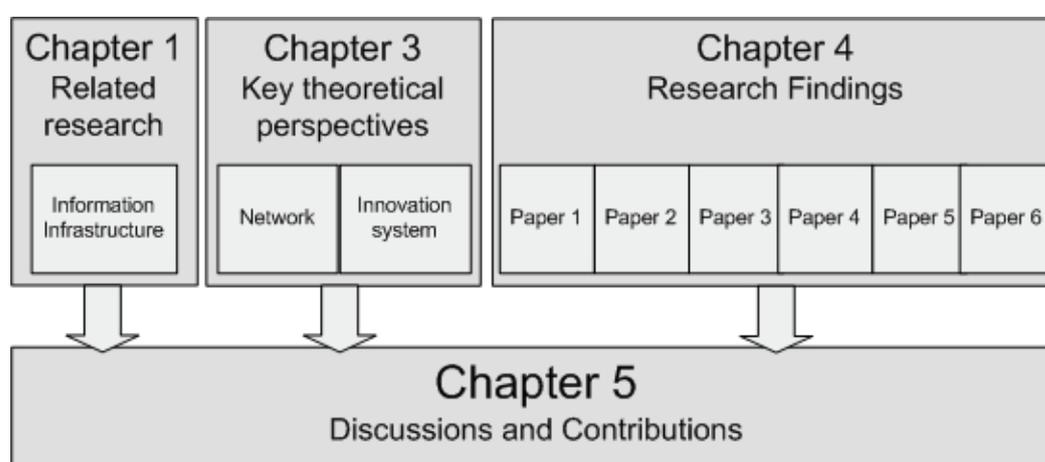
Figure 13 Input to this chapter

Table 10, below sums up the connections between the papers included in the thesis and the key concepts identified from the literature.

Table 10 Linkage between theoretical concepts and the published papers. (NC = Not relevant, X = relevant but not directly addressed, XX = relevant, XXX = Core topic addressed.)

	Paper 1	Paper 2	Paper 3	Paper 4	Paper 5	Paper 6
Top-down approach	NA	NA	XXX	XX	XX	XX
Bottom-up approach	X	X	XXX	XXX	XXX	XXX
Installed base	X	X	X	X	XXX	XXX
Cultivation	NA	NA	NA	NA	XXX	XXX
Complexity and couplings	NA	NA	X	NA	NA	X

	Paper 1	Paper 2	Paper 3	Paper 4	Paper 5	Paper 6
Reflexivity	NA	NA	X	NA	NA	X
Counter network	NA	XXX	X	NA	NA	X
Knowledge resources	XXX	X	X	XXX	NA	X
Relational resources	XXX	XXX	X	XXX	NA	X
Mobilisation	XXX	X	XXX	XXX	NA	X
Institutional capacity	XXX	XXX	XXX	XXX	XXX	X

The aim of the thesis is to identify factors contributing to knowledge and understanding of the interplay between technical and social factors in the development information infrastructures in rural areas (see Figure 14). The following sections address the key concepts from the theoretical perspectives described in chapter 3 and discuss them in relation to the attached papers. Some of the concepts overlap and are covered together while other are addressed separately, and they are presented in no particular order. Though first I want to address the relationship between the global challenges and change processes and the local response, this response, and how to respond is a task rural communities have to become better at.
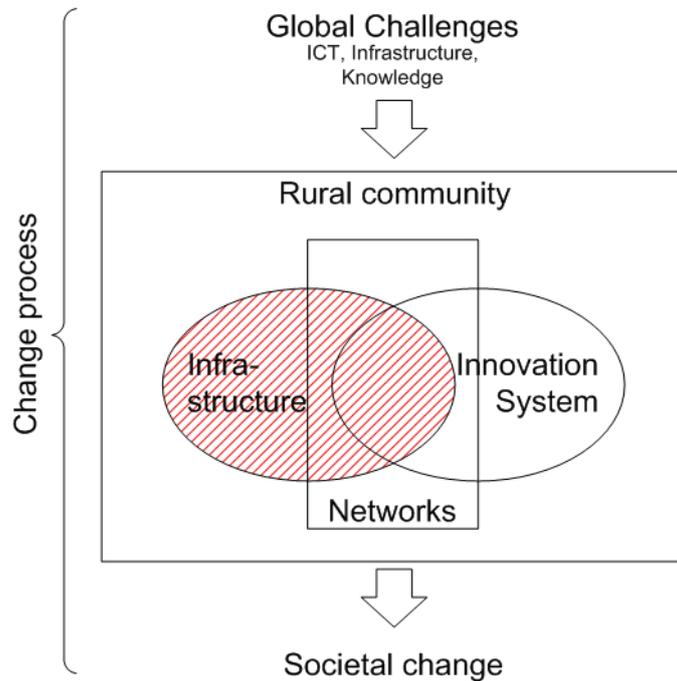
Figure 14 Defining area of contribution

5.1 Global challenges and local response

The thesis is about how local communities can respond to global challenges and change processes regarding implementation, use and utilisation of ICT. Both the network and the innovation system literature talk about changes in society but from different perspectives. While the network literature (among others, Castells, 2000c) take's a societal view of the changes over the last 30 years, innovation system literature (among others represented by Healey et al. 1999) has a more operational perspective on how to achieve such changes. Healey et al (1999) introduced the concept of institutional capacity building to assist in re-design of institutions and regions. Castells tries to explain changes in society in relation to broader changes in politics, economy and technology over a number of years. On the other hand, Healey et al. approach institutional capacity from a social constructivist perspective. Castells adopts a dialectical view to the relationship between technology and society. He sees technology and society as inseparable — one cannot be understood without the other. Castells' view that technology and society are inseparable can be seen as a parallel to the role given to information technology: "Information circulates through networks: networks between companies, networks within companies, personal networks, and computer networks. New information technologies are decisive in allowing such a flexible, adaptive model to actually work" (Castells, 2000c, p. 177). ICT is absent in Healey et al.'s contribution; it focuses on the organisational and knowledge components of the network. As networks become more complex and take a wider geographical spread, information technology becomes crucial, especially as part of the infrastructure supporting the networks. In observing the empirical setting for my work, technology is one of the important change forces behind the social changes taking place. This is not a catalyst in a deterministic way, rather it is modelled to the local needs.

5.1.1 Asymmetric development

The power structure in a network does not exist in the hierarchical structures but in the flow of information. Access to information is a prerequisite to participation in and influence over the operation of networks. Equal access to the technical infrastructure, that is equal access to sufficient bandwidth independent of location, becomes more important than before. Without this access, enterprises or communities will find it more difficult to compete for their place in the network society. Castells considers the development of a network society as asymmetric if it does not benefit all. The difference is between the actors that participate

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in the networks and change processes and the actors that are recipients of actions but who do not take active part in networks or change processes (Eriksen, 1998). In the regional innovation literature we often find that institutional capacity takes a long historical perspective and observe an "evolutionary trajectory" with some degree of path dependency (Healey et al., 1999; Putnam, 1993). Healey examines how institutional capacity can be developed to enable regions to let local initiatives meet the external forces caused by the globalisation of economies. The thesis looks at how these forces can be modelled according to the tradition and structure in the region to break away or make a change from the traditional path. The regional infrastructure is important in this modelling process, as is the ability to utilise the knowledge and relational resources and the mobilisation capabilities. If the regional infrastructure is going to have a function in the development of a region, then these three components are vital in relation to the knowledge and organisational components of the infrastructure.

Both the BookTownNet and the broadband development case were part of an attempt to balance developments in relation to the communities they serve. In 1998, at the time of the liberalisation of the telecom market in Norway, the initiators had a choice of waiting for the national provider to render services or taking an independent initiative. To ensure broadband access, the local initiators decided to act and as a result number of local initiatives and a programme to co-ordinate and ensure learning across initiatives was set up in the Sogn & Fjordane region. As a result the region has moved from the bottom of the access statistics to be among the best, with more than 80% by the end of 2006 (Vorland, 2006). They used local knowledge and relational resources in the process where available to ensure the successful development.

5.1.2 Development of networks

Castells does not talk about development of networks, i.e. the negotiations and elements that need to be in place for the establishment of a successful network. However, he does describe six transition patterns (Castells, 1996, pp. 152-168) for enterprises entering a networked society. Although these transition patterns are independent, they do influence each other. These transitions are a result of external forces, needs to become more competitive, that make the enterprise re-think their organisational structure in the same ways, as regions need to respond to external pressure. The transition patterns match in effect the transitions that

Healey et al. describe for regions: how can enterprises or regions meet the external change forces and model them to their own needs?

While Castells' theory of a network society reflects a macro or a societal perspective on development, Healey et al. adopt a meso-level analysis at a community level to develop institutional capacity. For example, they investigate the inter-linking of organisations such as public-private partnerships and further collective action toward a common goal, but it is also important to trace action at a micro level and in an operational manner; How to build networks and how well do functioning networks operate?

Healey et al. describe the networks as consisting of individuals who to a varying degree are involved in multiple "webs of social relations". These networks reflect the geographical space as discreet nodes that are connected with links. The network discriminates between the connected nodes and those not connected to the network (Törnqvist, 1997, p. 38). The networks can have different characteristics, some being hierarchical, others multidirectional, or have a star form. As Castells see it, the networks are more important than the traditional firms "Under the conditions of fast technological change, networks, not firms, have become the actual operating unit" (Castells, 2000c, p. 187). To explore the networks and their operation becomes important, the shape or configuration of the network will be a determining factor for how accessible the networks are.

One of the transition patterns is a multidirectional network between SMEs, both the BookTownNet and the broadband development cases are examples of such networks. In the BookTownNet case, the negotiation process involved three issues: different goals, decentralisation vs. local autonomy and degree of e-commerce. In particular, different goals for joining the network kept reappearing throughout the process and required continuous attention. A closer examination shows that it in reality are three intertwined networks, one for booksellers wanting to develop their own business, one for booksellers and others who were wishing to develop the book town and the local community and finally those wanting to develop the international network. As part of the negotiation process, the focal point of the network has become the development of the individual book towns and the community where they exist as opposed to development of the individual bookshop.

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5.1.3 Rural Networks

Three different levels are important for technological innovation (Storper, 1995, p. 896), the national level; the sector level (companies belonging to same business sector); and sub-national regions. The innovative capabilities in companies can be deliberately developed and there is a need to support innovative processes at firm, inter-firm and regional levels (Asheim, 1996). To achieve this, focus needs to be on learning — learning within a firm, between firms, and within the region. The existence and development of trust between organisations is crucial for innovation and learning in and between organisations in a network (Asheim, 1996). Sharing formal R&D-based knowledge does not require trust, but it is essential when addressing tacit and informal knowledge. As tacit knowledge is not based in the management of the organisation, there must also be trust within the organisation. This is easier in flat organisations as opposed to hierarchies, where trust issues may be harder to address. Tacit and informal knowledge is essential to the innovative processes within and between firms as "almost all innovations reflect already existing knowledge, combined in new ways" (Lundvall, 1992a, p. 8), which underlines the importance of sharing knowledge and experience across organisations.

In rural regions, most enterprises are small and medium and do not currently belong to a global network. Castells suggests that these enterprises have a road into the economy through collaboration. "The ability of small and medium businesses to link up in networks among themselves and with large corporations also became dependent on the availability of new technologies, once the networks' horizon (if not their daily operations) became global" (Castells, 2000c, p. 185). In order to join in the global networks it may be strategically necessary to first align with local or national networks and enter the global networks through them. It might require too many resources for a small enterprise to take a stepwise approach because it lacks the resources needed for a direct plunge. In the cross section between external pressure and local institutional capacities, there is an opportunity to change the trajectory of the entity, although it requires a lot of work. Regions that face external challenges by rejecting it are risking inertia through marginalisation. In the second trajectory, single enterprises in the region face the challenge and do their best in developing their own business, but there is no co-ordinated action in the region. This entails a risk of fragmentation in the region. The enterprises that act will have the opportunity to link up with networks outside the region, but probably at a higher expense. In this situation, the different actors will not be able to draw on each other in the process, but will have to "pave

their own road", and there is a risk of creating a divide between those taking part in the changes and those not connected. A better situation is when there are local networks that serve as arenas for learning. Such a construction is a defence against creating divides between those driving the change process and the others in the community. The benefit will be highest for the community if local networks are created to face the external forces of change. They will work together and there will be a mutual gain. Castells describes the process in the network in the following way "Inside the network, new possibilities are relentlessly created. Outside the networks, survival is increasingly difficult" (Castells, 2000c, p. 187).

Both the initiatives in the broadband development case are examples of such co-ordinated actions where a number of local organisations pooled their resources and initiated a joint effort in developing local broadband access network. At a regional level a task-force type organisation was created. It worked to motivate new areas to take their own initiative and played an active role in transferring experience and learning among a number of local initiatives.

5.1.4 Summing up

Rural communities face a challenge when the production in the network economy is too dependent on flow of information and processing capacity. The flow of information is reliant on access to infrastructure with sufficient capacity. Moreover, the processing capacity is inhibited by the "brain drain" occurring when young people move to urban areas for their education and opt against returning. According to Porter, competitive advantage is created and sustained through localised processes (Porter, 1990). Differences in national economic structures, values, cultures, institutions and histories contribute profoundly to a competitive success (Asheim & Isaksen, 1997a; Porter, 1990). In addition, Lundvall and Johnson (1994) and Storper (1995) point to learning and innovation as localised processes. According the innovation process and institutional setup is affected by the "specific mix prevailing at a certain time and place" (Lundvall, 1993). As a result, rural communities can learn from each other, but cannot indiscriminately copy a solution from a different setting. They need to create localised processes, taking in local knowledge and relational resources.

5.2 Institutional Capacity

The institutional capacity in a community determines how external challenges are met. Institutional capacity as mentioned in chapter 3 is defined as a combination of knowledge resources, relational resources and mobilisation capability in a community (Healey et al., 1999). A weak local capacity leads to a path-dependent development or to a fragmented development where those with technological inclinations will improve their own conditions while leaving the others out. A strong local capacity can lead to inertia in a community where this strong capacity is used to fight against the external change forces. Alternatively, the community can use the capacity to model the change forces to address local needs. The institutional capacity is the most important set of factors for innovation in rural communities. Institutional capacity is something communities have, but also can develop, the institutional capacity is what enable communities to reflect in external change forces and adopt what is relevant and discard the irrelevant aspects. All communities, both urban and rural, are facing global challenges. Communities that would like to reflect on the change forces and to model them to local needs must take deliberate steps to strengthen their institutional capacity. The increasing flow of challenges from global processes and increasing dependency on ICT are challenges that are particularly difficult for rural areas to deal with.

Paper 1 and 3 address how a group of rural communities and rural SMEs work together in a network to face the Internet challenge. The book towns initially had a loose network between them. This network was the basis for the project collaboration. Internet was both a new opportunity and a challenge for the book towns. As part of the initiation process, the network needed to be strengthened with additional knowledge resources. This was done by identifying and contacting two R&D organisations; one had previously researched tourism aspects of the book towns and one could contribute project management and ICT skills. Together with the network of book towns, they actively participated in defining the project and activities (Paper 3). The initiators managed in this way to mobilise the network with knowledge resources they had available internally and use the relational resources to find lacking knowledge resources and ensure support from the different towns and booksellers. Paper 1 addressed how the use of the Internet had strengthened the communication in the network that is between book towns and booksellers in the different towns. This network is

part of the institutional capacity of the individual book town, when addressing new challenges they can do so with the help of the international network.

Paper 4 and 5 address the role of the development of the institutional capacity in the broadband development case. In this case, the challenge was to ensure access to high capacity broadband infrastructure at a competitive cost. In one initiative, the available local actors were gathered into the initiative. The knowledge resources available were limited, but they were willing to learn and absorb new ideas. There were no clear power relations in the network; actors represented more or less the same size of users. In the other initiative, the knowledge resources were well developed and the key players participated in the initiative. The network represented several large organisations with a certain power over other smaller actors. However, they were aware of their role and these power relations have not been an issue in the development.

Working in a network such as the BookTownNet project is both a challenge and a way forward, as addressed in paper 1 and 2

- For each book town to have access to knowledge resources such as those represented by the R&D organisations would cost too much, given the marginal economy of the book towns
- By pooling resources they faced a set of challenges and strengthened their innovative capabilities
- By pooling resources and working together, they funded a project that strengthened the international network between bookshops and book towns.
- Lack of support in the regional innovation system can partly be compensated by working together in a Pan-European network.
- Use of ICT made it easier to work together to develop the book towns

The composition of the institutional capacity is important for the development in a process, but if the capacity has weak spots, this can be strengthened by seeking partnership with other initiatives or knowledge resources. Both the book town case and the weaker broadband initiative are examples of this.

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Summing up, the concept institutional capacity stems from the regional innovation system perspective, but I also see use for this concept within the information infrastructure perspective. As part of any development process it is important to be aware of the knowledge and relational resources that apply to the information infrastructure, these resources are part of the installed base, and will be useful when aligning the interests and expanding the actor-network of the infrastructure. The relational resources and the mobilisation capability may also tell something about the growth potential of the information infrastructure, or they might be the seed to establish a network to counter a particular development.

5.3 Counter network

The term counter-network as defined in chapter 3 is inspired from Castells (1997, pp. 72-81) on counter movements and defined Mosse and Sahay (2001, p. 179) to describe a process where marginalised groups take part in socio-economic development processes. The term is not used in any of the papers, but describes networks of groups which act to counter a particular development. Both the book town case and the broadband initiatives represent marginalised groups that counter the challenges posed by the information society to rural communities in an attempt to bridge or reduce the divide.

The networks in my study are different from the Zapatista and other counter movements that Castells describes. They aim to counter the development that will create a gap between urban and rural areas with regard to use of ICT. The rural networks are established to ensure that the rural communities get the same opportunities and level of access as in more urban area. Castells counter networks have a common identity defined by "history, geography, or biology" creating a natural boundary (Castells, 1997, p. 9). In the BookTownNet case the history of the towns and their geography are common. All towns have been developed following the example from the first book town Hay on Wye. In terms of geography they are not located in the same geographical area, but spread across Europe, but all are located in rural areas and at the time of the initiation of the town in need of regeneration and new development. Another common aspect is content of the communities which are an economy dependent on buying and selling second hand books. In the broadband case geography is the strongest identifying aspect but history also play a role.

The initiatives are all representing "natural" geographical sites, delimited by either regional, municipal or community borders.

Paper three explores four development projects spawned to create the European information society. All four had a focus on rural areas and supported learning and better use of ICT in homes, businesses and the public sector. All four projects represented localised development processes, and operated in the friction between the top-down structures imposed at the programme level and the localised fulfilment of the expectations in the communities. In a top-down development process, more attention is paid to fulfilling the expectations set out in national and international strategy documents. When working with these issues in bottom-up, localised processes (Porter, 1990) there is a need to address the issues from a different perspective. The local needs must be in focus; in this way it is possible to create a sense of ownership to the process. Having such a focus is part of an institutional capacity building process, strengthening both the knowledge and relational resources in the community. In the BookTownNet case the towns had a common identity as rural towns specialising on second hand books. All towns are based on the idea of the first book town Hay on Wye, but have been modelled to the local context in each of the other towns.

Moving to the broadband development case, the organisations behind these initiatives wanted to avoid falling behind with regard to broadband development. One of the initiatives had an access point in the town. However, it had no access network. They utilised the knowledge about local conditions to develop a local infrastructure to create an access network to connect businesses and organisations to the access point. In addition they reduced costs by collaborating, because the pricing structure offers a discount based on quantum; to rent 2 Mbit/s is 40 times more expensive per bit than renting 622Mbit/s (Teleplan, 2003). If the organisations had patiently waited it would have taken more time to get access to the same quality service and the cost would have been much higher. In the other initiative, the counter-action gave the community access to broadband services four years before the national providers delivered such services in the community.

In the following I will sum up the coverage of counter network and how I see it relevant to the contribution of the thesis. The counter network concept stems from the network perspective. The concept can be used in relation to processes in rural innovation systems.

Counter networks can to some degree be seen as equivalent to the concept institutional capacity, because the counter-domination networks have to also have to have capacity in form of knowledge and relational resources and mobilisation capabilities.

5.4 Design to Reduce Complexity

One aspect that influences the development in a network organisation is the vulnerability and resilience of the network or an initiative. As referred to in chapter 3, Perrow (1999) defines two continua; the degree of complexity and the degree of slack in the couplings or relations in a network. Perrow systematically links these two continua and depending on the score it says something about the resilience and vulnerability of the analysed object (Figure 15). In the following, I will use these concepts to reflect on the BookTownNet case and the broadband development case.
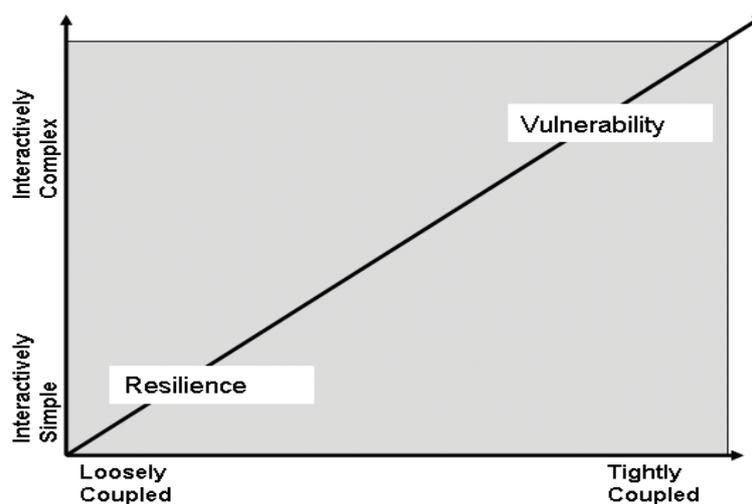
Figure 15 Relationship between Resilience and Vulnerability as a result of the complexity and couplings in the network

The BookTownNet case is characterised by loose couplings, instances happening in one town will rarely have a direct influence on the operation in one of the other towns. Scaling to within a town it is still loosely coupled, only in very few instances will occurrences' happening in one shop influence the operations of another shop. At this scale there will be differences from town to town, but generally this is the case. There are of cause core persons who are more central to the operation, who might be more tightly coupled to others both within and between towns, and in particular in the International Book Town Organisation which has a board of five members.

At the same time, I will characterise the case as interactively complex, based on the type and variety of issues addressed by the network. Issues adding to the complexity are:

- Different languages and cultures required special attention
- In the development project the different actors had various expectations to the outcome of the work (paper 3) (Table **7**)
- The range of issues brought to the network in addition to the tasks related to the project and the operation of the network. Participants also brought forward conflict issues that needed to be addressed to secure the continued operation of the network.

In sum the BookTownNet case can be considered rather more resilient than vulnerable; they will recover quickly from any misfortune.

Within the broadband case, Firdanett is a relatively tightly coupled network, it is dependent on a very few persons and the economy is limited. In addition to the number of persons directly involved, the network lacks additional knowledge resources as backup in the network. Another aspect that makes the network tightly coupled is the number of users and their capacity requirements, which makes Firdanett vulnerable, because as other commercial providers come to the region they will easily be able to deliver the same capacity at a competitive price. Firdanett is interactively complex, because of a large number of particular types of interacting parts. Among these is the use of a radio link for connecting to national trunk-network and the remote communities and a fibre network and wireless to reach the consumer. Firdanett is rather more vulnerable than resilient; when errors occur there are many places and types of technology that can be at fault.

Kapasitetslaget is a relatively loosely coupled network; it can handle errors and has access to a network of skilled persons to help solve unexpected problems. The customers and participants in the network are dominated by large public organisations and businesses requiring high-capacity access. Even if one or more of them could find other suppliers, this is less likely because of the economic incentive in the network; they are not doing this for profit but to get the lowest cost. At the same time, they are dependent on suppliers of infrastructure to connect to the Internet. There have been instances where the network has been down for this reason. Kapasitetslaget is a well aligned network and on the interactive scale it is less complex than Firdanett. But Kapasitetslaget has a large number of interacting parts, although not the same degree of variety. Another issue adding to complexity is that it

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does not own most of its own infrastructure, rather it rents access to fibre from a number of different owners. Kapasitetslaget can be considered to have a certain degree of vulnerability and a certain degree of resilience.

Tightly coupled and interactively complex systems have a high degree of vulnerability, i.e. they are more vulnerable to errors in their own or connected structures. A loosely coupled system, which is interactively simple, may be a system that is difficult to change; its resilience makes it difficult to change. In the lifetime of a process, the vulnerability-resilience grade will be changing through the process. Each initiative should assess its vulnerability at regular intervals, identifying aspects of the development that make it more or less vulnerable. This might say something about which issues should be addressed in the development. The ideal might be to create systems with a high degree of resilience, but this might not be possible when working with ICT in rural areas. When taking counter-actions the objective may be to take on something that has a high degree of complexity and vulnerability, to bridge the divide separating the marginalised group from the norm.

Summing up the coverage of complexity and couplings and its contribution to the thesis, the concepts complexity and couplings stem from the networks perspective. It is in line with Hansen and Lyytinen's (2006) principles for cultivation of information infrastructures which keeps the complexity low by recommending to cultivate the installed base by adding new components which are simple and inexpensive and by focusing on the first adapters and small user groups, rather than an broad approach. Such an approach keeps the number of connections low and the interactive complexity low.

5.5 Bottom-Up vs. Top-Down Development Processes

Top-down development processes are results of initiatives taken higher up in the system, for instance, as a result of political strategy processes. Often top-down processes do not involve the end users until rather late in the process, if at all. While top-down processes rely on strategies and grand plans managed by experts, bottom-up initiatives rely on the involvement of end users in all parts of the development process from the initiation, project development and operation. When developing information infrastructures both approaches can be applied. Developing the transport layers of an infrastructure is often done in top-down manner, but as in case of broadband in rural area the top down approach don't deliver

all the way, lack of market demand, because of low population density and a high degree of small enterprises stops the development before it reach all potential users. This creates a divide between those who have and those who do not have access. Bottom-up development processes can be used to fill this gap.

5.5.1 Cultivation as a Bottom-up Development

Cultivation can be used as a tool in bottom-up development processes. As referred to in chapter 3, cultivation is a concept from agriculture, which hints of a development process aimed at selecting, assembling and refining components but also to using the material itself as part of the growth process. When developing information infrastructures, it refers among other things to the process of utilising the existing installed base as foundation for new growth; self-reinforcing growth (Hanseth & Lyytinen, 2006 p. 17). In creating a self-reinforcing process, focus on usefulness for the first adapters and the size of the user groups is a way of ensuring momentum and creating a critical mass of users. Another way of building momentum is to extend the available installed base. When building on the installed base the new components need to be simple and inexpensive, but they still need to fulfil the main aim of creating a useful service. They have to fill the connection to the existing entity using an interface based on standards and gateways, but it is also easier for potential users to connect to the infrastructure without making a total break from the known and existing entity. Improvements should be on a "needs" basis, rather than a "nice-to-have" basis. Throughout the whole process the alignment of interest should take place in parallel to the building process; part of this is also a process of developing a support community for the infrastructure. In this way, the new infrastructure is built brick-by-brick as part of a bottom-up strategy. At the same time, it is important to avoid lock-in situations by focusing on simple, modularised and dispensable components and the use of gateways between different layers and components and to neighbouring infrastructures.

In the BookTownNet case (paper 1+2+3), an infrastructure was developed to support a network between the book towns. In the BookTownNet case, the bottom-up development has not been specifically addressed in the papers. The contract with the funding organisation described a more traditional iterative development process, involving a user needs analysis, specification, development and testing. Following the analysis of the user needs, a more bottom-up approach was chosen to develop the services in an attempt to ensure that what was developed was what was needed. One of the aims was to improve the

ICT skills among those participating. Initially in the project only some of the towns and persons participating in the project had experience with Internet and email, and others were about to have their first encounter with a computer. The initial step was therefore to give all participants a course in use of Internet and email and get them set up with computers. Because of this starting point, the architecture was designed to allow easy plug-and-play testing of modules. In this way, the system could be tested out and modules that were not used or proven not useful could be removed after a test period. The development work was carried out 'according to the textbook' and as a democratic process. It turned out that even though it functioned well, it was insufficient. The users experienced that things take longer than anticipated, and as the users were learning more and more about the technology their needs and expectations were changing; starting from a basic level, the expectations became more sophisticated as the process moved along, which made the developing process to a aim to reach a moving target, this is a difficult situation in a time and resource limited project, but at the end of the project we had a number of operational services. The system that was developed allowed both the bookshops and the book towns to have a common communication channel between each other in an intranet and to the wider Internet audience.

In the broadband development case (paper 4+5+6), focus has been on the bottom-up development of the infrastructure. The emphasis is on bottom-up as an alternative to top-down rollout in a deregulated market governed by market forces. All three papers look at how work is done to bridge the broadband divide in the region Sogn & Fjordane by exploring a regional co-ordination initiative and specific local initiatives. In paper 4, the two initiatives are compared to a regional development initiative and do not have a particular focus on bottom-up development, this paper will be addressed later.

Paper 5 analyses two instances of how the local actors are bridging the rural broadband divide. They present an alternative to the traditional rollout of telecom infrastructure, a bottom-up development of broadband infrastructure to bridge the broadband gap in rural communities in Sogn & Fjordane. Individuals, businesses and the public sector in several rural communities have joined forces and taken the initiative to develop and operate a local broadband infrastructure. Each initiative faced a different set of challenges depending on the local context.

The paper opens up the 'black box' of the cultivation process to identify factors contributing to the two developments. Two initiatives are used to illustrate how the communities have cultivated the broadband access using available knowledge and relational resources and infrastructure. By doing so they have aggregated a sufficient demand for broadband to support the investments needed. There are several similarities between the two cases but also significant differences. The factors identified are; the strategy chosen; the main actors and contributors in the development; prior knowledge; economy; motivation/ alignment; infrastructure / installed base; and the first adopters. The main differences in the cases are

- Actors: Scale and type of actors, in one initiative followed a traditional triple helix model with public sector, businesses and R&D organisations, while the other missed the R&D sector. In addition the public sector partner is much smaller and less influential on the processes. As a result the initiative was more dependent on the private sector and having a larger number of SMEs as customers.

- Prior knowledge: In one initiative access to knowledge about setting up and operating a broadband network was readily available. The college that had planned and operated a broadband network between its many facilities was one of the partners. In the other initiative, there were no such skills available.

- Economy: The initiative with the smallest actors and little access to knowledge needed to employ two persons to take care of the customer base and technical development. While the other had a sufficient number of large user organisations from the start, increasing the number of customers was therefore not necessary. In addition, the large organisations let their own employees take care of the technical operation in the beginning; the income to the company could therefore be used to improve the technology. Later on administrative and operational services are out-sourced to a company.

- Alignment: The two initiatives had a different degree of alignment. One had a number of larger organisations that could set the agenda and in principle did not need other participants. In the other initiative, the number of participants was larger and there was no strong alignment. After about one year of operation, it became clear that there was a disagreement amongst the owners with regard to priorities. As a result, services connected with the infrastructure, such as backup, server space etc. were transferred back to the local ICT firm, while the remaining owners refinanced the company (which also changed its name to Firdanett at that time). The local

energy company was the majority owner of Firdanett, whereas the chamber of commerce and the municipality were minority owners.

- Installed base: The last main difference is that the larger initiative had access to an existing fibre infrastructure, which was the basis for the development. Whereas the other initiative needed to develop everything from scratch.

Both initiatives have been successful in their effort, but one had to follow a more difficult path, and learn as the path unfolded. How can we prepare ourselves and the community for such development processes? Can we prepare better?

5.5.2 Exploring the installed base – Descriptive clusters

Paper 6 explores use of descriptive clusters as a way to explore the installed base in the development context. The descriptive clusters are inspired by and derived from Schön's work on the 'reflective practitioner' which explore how professional groups think in action (Schön, 1991). When dealing with a bottom-up cultivation of infrastructure, for instance in rural areas, a high grade of complexity is encountered and there is a need to explore features of the available local installed base before and during the cultivation process. An installed base in general is the available infrastructure – the existing standards, technical and non-technical components needed to operate an infrastructure or develop it further – to cultivate it. An infrastructure is never developed from scratch, it is an extension to the existing installed base (Hanseth & Lyytinen, 2006); therefore there is always an existing installed base that can be cultivated. In a bottom-up process it is necessary to start by to examining the installed base in a local community, to identify what is the starting point and identify actors that can be aligned and utilised in the cultivation process. In a rural setting and across organisational borders the process of exploring the installed base is complex and there are many factors to consider. One of the challenges is to identify the installed base and consider how to best utilise it in the design process.

Reflective conversation with the situation

Schön's (1991) "reflective conversation with the situation" offers a framework for reflecting about a development. In an effort to identify "the reflective practitioner", Schön explores the teacher-student relationship in one of the design professions – architecture, which includes urban design, regional planning and town planning. Design processes for infrastructures in

general and information infrastructures are met with many of the same challenges that the architect meets when approaching the location for a new development. Schön's (1991) "reflective conversation with the situation" views the development process using three dimensions: the design; the implications discovered in the process and changing stance in regard to the situation, going from a unit level to considering the whole. When an architect is designing a new construction – a house, a campus, the utilisation of a plot of land – there are a number of existing factors influencing the design – the installed base. Existing buildings at the site may influence the design and any decision made in the design phase may influence later decisions. In performing this reflective conversation, the designer takes different stances in relation to the object and location. Hanseth and Lyytinen (2006) claim that we need to draw upon and expand the existing installed base. However, they do not offer a framework for assessing and reflecting upon the installed base and its influence on the design of the new infrastructure.

Twelve descriptive clusters

For the design dimension Schön (1991) describes twelve clusters of elements depicting the features, relations and actions related to the architectural design and the norms to evaluate problems, consequences and implications. The descriptive clusters focus on the site, i.e. the factors specific to the location that influence development, and how components may be organised in relation to each other. They also focus on the use and function of the construction, including the elements that need to be in place. The descriptive clusters are part of a process of making design decisions, but also part of a process of "zooming in and out" from a unit level to the whole as part of a process of considering the design implications from a number of shifting viewpoints. Hanseth and Lyytinen's (2006) framework and Schön's (1991) descriptive clusters can be used as an aid in the design process, guiding the development. In the planning process, the descriptive clusters can be used as a clue to describe the initial installed base and the considerations needed to further cultivate it. The descriptive clusters become rhetorical questions to uncover the installed base and the "what if" and "if … then …" considerations are needed as part of the cultivation process that identifies the opportunity space of the local development.

Using the descriptive clusters can be one way to uncover the point of departure for a development. The questions and answers describe important inputs to the development

process, and in using them, it is possible to get an overview over the kinds of resources that are available, the installed base, and the kinds of choices that needs to be taken. In addition, the use of a tool like the descriptive clusters also puts a focus on the local context and culture in the community. With a bottom-up strategy, the questions have to be answered in relation to the local context. When moving from one location to another there are things to be learned but it will be impossible to make blueprint implementations.

<u>Using descriptive clusters</u>

Paper 6 starts from Schön's framework for architecture and redefined it to create a "reflective conversation" in relation to broadband infrastructure, and in particular in relation to the design dimension. Further it suggests that the framework also offer a starting point that can be developed to explore the installed base or context for information infrastructures in general. Table 9 (see page 66) lists the redefined clusters with a definition and sample questions to ask. The original twelve descriptive clusters (Schön, 1991) have been examined, combined and redefined into ten descriptive clusters which cover areas relevant to the local broadband context. According to Schön, when an architect is designing a new construction, a house, a campus, the utilisation of a plot, there are a number of existing factors influencing the design – the installed base. This is the same type of process that needs to be done when developing local information infrastructures. Hanseth and Lyytinen (2006) claim that we need to draw upon and expand the existing installed base. However, they do not offer a framework for assessing and reflecting upon the installed base and its influence on the design of the new infrastructure. Any decision made in the design phase may influence later decisions. In performing this reflective conversation the designer takes different stances in relation to the object and location. The descriptive clusters focus on the site, i.e. the factors which influence the development that are specific to the location, and how components may be organised in relation to each other. They also focus on the use and function of the construction, including the elements that need to be in place. The descriptive clusters are part of a process of making design decisions, but also part of a process of "zooming in and out" from a unit level to the whole as part of a process of considering the design implications from a number of shifting viewpoints.

In the broadband case the descriptive clusters could have been useful when uncovering the initial situation to uncover aspects of the site as part of a bottom-up cultivation process. In

all cultivation processes there will be some degree of uncertainties. To reduce the uncertainties it is necessary to know as much as possible about local conditions and actors that the project should be aligned with (that is the knowledge and relational resources), the technical infrastructure already in place and considerations of which components need to be added as part of the cultivation process. The two local broadband initiatives were analysed to identify a set of questions addressing key contributing factors to a bottom-up cultivation of broadband infrastructure. This was discussed against Schön's descriptive clusters, and redefined to the broadband domain. In most cases the name of the cluster is the same, while the description in adjusted to the new domain. The proposal is that the descriptive clusters can become a tool to identify the opportunity space of the local broadband development, that is a set of rhetorical questions for uncovering the installed base and the choices that need to be considered, i.e. the "what if" and "if … then …" considerations that need to be taken as part of the cultivation process.

To sum up the coverage of descriptive clusters in relation to information infrastructure development, the concept descriptive cluster is borrowed from Schön (1991) and his use of this and other concepts is based on practical experience and an epistemology of practice. I suggest that this concept have a place also in the practice of information infrastructure development and in particular in relation to rural areas. The descriptive clusters can be used to uncover the starting point of a development. The answers to the questions describe important inputs into the development process, and in using them it is possible to gain an overview of what kinds of resources are available, of the features installed base and of the kinds of decisions that need to be taken. In addition, the use of a tool like the descriptive clusters also puts the focus on the local context and culture in the community. With a bottom-up strategy questions have to be answered in relation to the local context. When changing from one location to another there are always things to be learned, but the bottom-up strategy makes it impossible to make blue-print implementations. What can be transferred are rather the relevant methods and experience of dealing with a type of problem situation.

5.6 Rural reflexivity - Reflexive modernisation as a rural development issue

In the risk society (Beck, 1992) where the basic social forms and principles of industrial society are challenged by global problems, the risk society influences all communities reflexively. Such a development opens up for a new social form, or new social movements "shaping society from below" (Beck, Giddens, & Lash, 1994 p. 23). Beck and Lash's reflexivity represents a non-linear modernity. Changes are a result of a combination of external and internal change forces, external through global networks and internal through feedback loops (Lash, 2003). Furthermore, it is characterised both by reflexes and by reflections (Szerszynski, Lash, & Wynne, 1996 p. 7); global change processes are reflected on the rural communities, and this may cause the rural communities to reflect about how they can cope with these change processes. The sum of this is reflexivity: both reflexes and reflections. In this context, we may have individual reflexivity, institutional reflexivity and societal reflexivity. My contribution is at the institutional and social level; institutionally through the process of institutional capacity building and socially expressed through the term rural reflexivity.

In essence reflexivity is to a large extent related to contexts where the social and technical spheres meet; the interface between social and technical (Lash, 2003 p. 55). The social spheres have a choice of responding to these challenges, but the choice needs to be immediate, to make quick decision to avoid falling too far behind in development. The "risk society automatically produces reflexivity, and then – perhaps – reflection" (Szerszynski et al., 1996p. 8) often a response to such reflexivity is to "put together networks, construct alliances, make deals" (Lash, 2003 p. 51).

In the context of the thesis I see this reflexivity both in the way the institutional capacity is utilised to model global change forces and related to that to the establishment and operation of counter networks to get a more balances development. The broadband development case is a good example of rural reflexivity. In 1998, the telecommunication marked was liberalised. At the same time the demand for more broadband communication increased. Soon after the liberalisation of the telecommunication market, organisations in Sogn & Fjordane region initiated local collaborations to improve their own access (addressed in Paper 4, 5 & 6). To bridge the broadband divide individuals, businesses and public sector

joined forces and took initiative to developing and operating local broadband infrastructure. Both the Firdanett and Kapasitetslaget initiatives can be traced back to projects initiated in 1999. Other initiatives followed (see Table 3). The development process has been one of reflection; how to face the challenge in the best way, but also influenced reflexively by new global events.

In Paper 6, an attempt is done to make a framework assessing 'reflection', which allows us to learn more about the installed base at an early time in the process. The framework is modelled on Schön's (1991) "reflective conversation with the situation". Design processes for infrastructures in general and information infrastructures face many of the same challenges that the architect meets when approaching the location for a new development. In search for more information about exploring the installed base I was therefore inspired by Schön (1991) and his "reflective conversation with the situation", which views the process using three dimensions: the design; the implications discovered in the process; and changing stance regarding the situation, going from unit level to considering the whole. This paper uses the framework as described by Schön for architecture as a model to create a "reflective conversation" in relation to broadband infrastructure, and in particular, the design dimensions, which offer a framework for uncovering the installed base and components that can be used in the bottom-up development. The motivation for using such a framework is to critically examine the local infrastructure to identify possible components, equipment, systems, applications, processes and people that is the technical and organisational structures that can be used as a part of the bottom-up development process. The aim in taking such a step is to reduce the uncertainties of the development. This is not achieved by examining the installed base alone, but in combination with the two other dimensions proposed by Schön, a critical study of the implications of issues discovered in the design dimension and examining the development for different stances.

To sum up, the concept of reflexivity comes from the network perspective. I have chosen to include it at this level because I illustrate the additional affect of global change processes, the reflexivity which through global and local feedback loops which creates a continuous development process, because when you think you are finishing then new and additional challenges emerge. In relation to broadband development, not long after having delivered broadband in an area, new services and an increasing number of users might cause the next counter action to be related bandwidth with higher capacity. Another effect we have seen is

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one of friendly takeovers and mergers between these local broadband companies, among other to create a more sustainable operation of the network and for those taking over to expand their service area (in 2004 Firdanett was taken over by another local broadband initiative Enivest (Table 3).

5.7 Information infrastructure and rural innovations systems

Innovation in rural communities differ from urban communities in many aspects, below is a list of some of the challenges the difference pose:

- Few persons and net out migration – knowledge resources are scarcer, but people moving out can be valuable relational resources in an initiative. This relational resource can also be valuable in the mobilisation process in that the relational resource can help identify opportunities and mobilisation techniques.

- Many communities are based on one type of industry as main employer, these communities these enterprise often take action on behalf of the community without consulting. This may lead to a more marginalised community more dependent on the one resource represented by the enterprise rather than achieving a balanced development. A more balanced development would involve more actors in the community in a more democratic process.

- Multitasking: In rural communities many inhabitants have more than one employer, they are getting their livelihood from working part time for more than one company, either based on season or on a more regular basis (Høyer, 2004, p. 27-32).

- Many small companies who do not manage to contribute to collective innovation in addition to operate own business.

- The importance of public sector organisations for the community. The municipal administration is often a large employer compared to number of inhabitants in a small municipality (Høyer, 2004, pp. 22-26). In addition it is also often one of the few employers who require higher education level.

- A business structure dominated by branch offices – In many rural communities the business structure has become dominated by branch offices partly corporations, partly through friendly or unfriendly takeovers and partly through ownership (Høyer, 2004, p. 20-21).
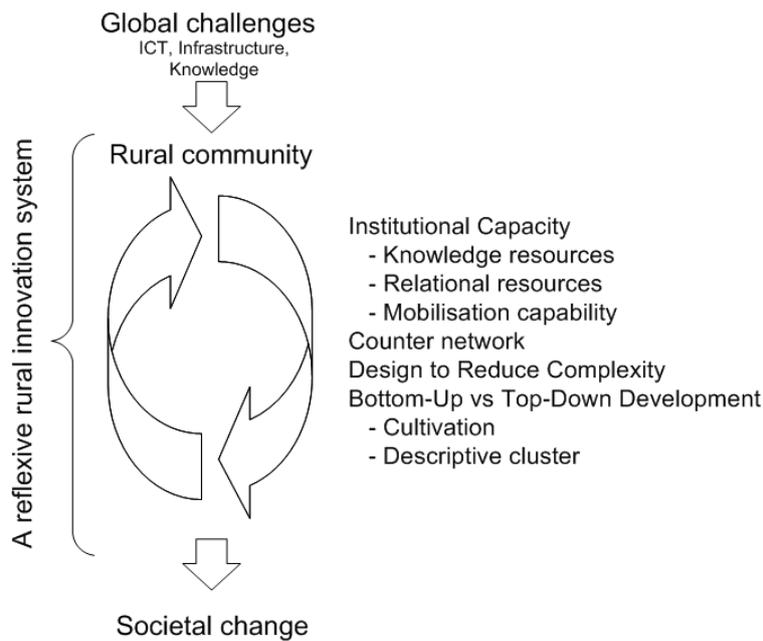
Figure 16 Factors influencing the introduction of Information systems in a rural context

These conditions and the degree that these and other conditions occur with pose challenges to rural communities. It is therefore important that rural communities pay special attention in the effort to model external challenges to the local conditions; Figure 16 above is a conceptual framework which illustrates the process. The process is represented by the circular arrows in the middle, which also represent the reflexive nature of such a process. To the right is listed a number of macro factors which will influence the implementation of information infrastructures in rural area. The first three; Institutional capacity, Counter networks and Design to reduce complexity; are related to the design and planning aspects of such initiatives, while the last Bottom-up vs. top-down development relates to factors addressing the development process.

To face global challenges and change forces a strong institutional capacity is one factor contributing to how the local community handle such a challenge. Assessing the institutional capacity through mapping knowledge and relational resources in the community is one way to start. When a new challenge occurs the community can mobilise knowledge and relational resources in the counter network more easily. The counter networks need to model the challenge to the local conditions. Not all challenges needs to be dealt with in the same way, some challenges directly influence the conditions in a community while others have little or no influence. The local knowledge resources need to

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be involved in sorting issues according to relevance for the community. When actions are needed the actions in the network must be designed to find a balance between resilience and vulnerability, by finding the right degree of complexity and the couplings in the network it is possible to find an appropriate balance where the actors are willing to take the risk. The work described in this thesis reflects the situation where top down developments do not provide sufficient infrastructure, there is a need for a local action to bridge the potential gap, in the BookTownNet case, to learn and adapt to the information society, and in the broadband case to build local infrastructure to connect to the national infrastructure to get high speed access to information, applications and services on the Internet. In those instances that top-down delivery fail, this is a challenge that the local community can choose to address. In relation to information systems it is my suggestion that descriptive clusters can be used to explore the installed base and plan the development, and that using this in combination with a cultivation approach to the development. In this way it is possible to use the installed base as a foundation for the development while address the needs of the first adapters by selecting, assembling and refining the information infrastructure. As rural communities address and model global change forces they improve their conditions, they contribute to the reflexivity in society, this reflexivity involve both local feedback loops and feedback loops to the global society which may reflex back to the community itself with new challenges.

5.8 Conclusions

This section starts with an effort to summarise the findings of the thesis, following the summary I will go on to briefly discuss strengths and weaknesses of the thesis, before offering some concluding remarks.

The purpose of this thesis has been to present a theoretically informed empirical analysis of the local adaptation of global challenges related to introduction and advances use of information systems; the introduction of computers and internet for collaboration in the BookTownNet case and the local process of establishing broadband infrastructure in the region of Sogn & Fjordane.

Using the related research and the theoretical perspectives I have tried to show the link between the global and the local. That is how global challenges posed by changing national

and international conditions influence local, rural communities, and how these communities can act in response to these challenges and change forces. The global is here represented by the information society and changing conditions as a result of a society more dependent on information processing and knowledge creation rather than production of material products. These changes are a challenge to rural communities which are characterised by longer distances between inhabitants and businesses, a diverse in nature, some dependent on primary industries, others depending on single industries and a large number of very small businesses.   Facing these challenges local, rural communities are at risk of being marginalised, because the cost of delivering services in a market economy is too high to serve these areas. To get the same conditions as more urban areas they need to mobilise resources to create networks which enable them to counter the development that is to create a bride across a possible divide and in this way improve their own conditions.
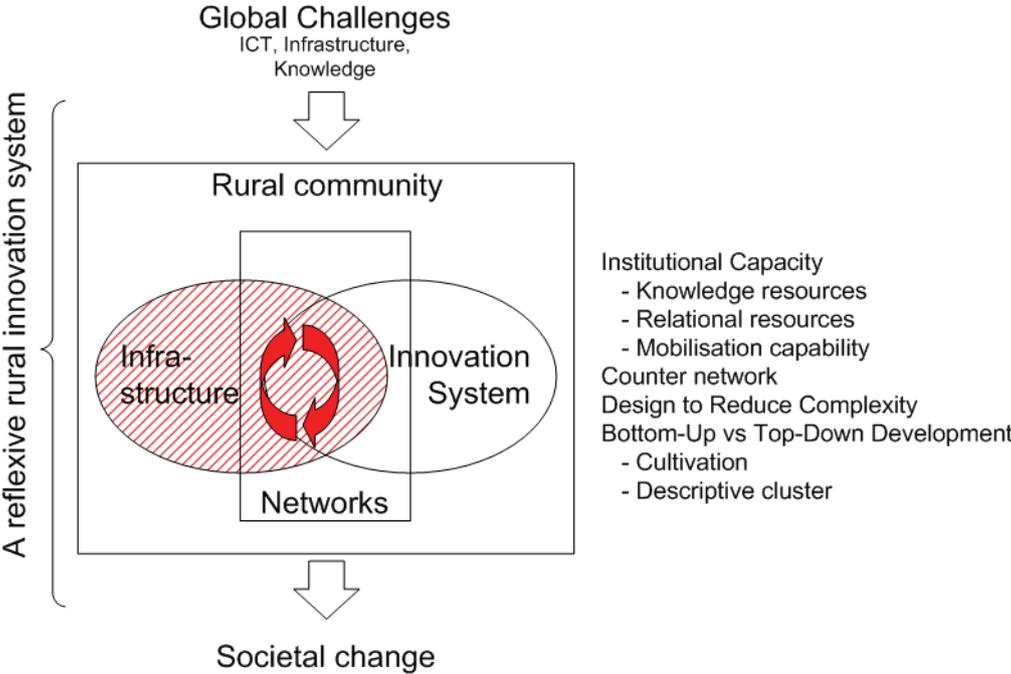
Figure 17 Conceptual framework describing factors influencing infrastructure development in a rural context

The aim of the thesis is to contribute both theoretically and in practice to knowledge and understanding of the contextual factors which may influence the introduction of information infrastructures in a rural context. The conceptual framework described in Figure 17 above is based the analysis of the three empirical studies analysed in relation to the related research and the theoretical perspectives. The concepts listed to the right of the figure are

concepts derived from the literature and discussed in relation to the cases. It is my opinion that these concepts represent important factors influencing the adaptation of global challenges and change forces in rural communities.

The thesis makes its contribution to the research area on development of information infrastructures (Hanseth, 2000b; Hanseth & Lyytinen, 2006; Monteiro, 2000; Star & Ruhleder, 1996) in a rural context. The thesis contributes both by real life implications and theoretical to the discussion of information infrastructures and their implementation in rural area. The rural context and the technological components are mutually influencing each other in the process of developing the information infrastructure. In particular I will point to the importance of the institutional capacity in relation to infrastructure development. Hanseth and Lyytinen (2006) point to the importance of the installed base, the institutional capacity is in many respects part of the installed base in a community, that is the knowledge and relational resources, including the knowledge about how to mobilise the network to get an initiative operational. In relation to this I will also point to the introduction of descriptive clusters as a concept to explore the installed base (introduced in paper 6, inspired from Schön (1991)). When working in a rural context the installed base is something more than technical components, it is the combined infrastructure available, that is both the technical and non technical parts of the embedded in the community which among other include the collaborative relations in the community, the skills and knowledge available within the community or in the network surrounding the community. In some instances it may also include geographical conditions, such as in relation to broadband development where the layout and spread of inhabitants and businesses are one condition influencing the implementation. At the same time it is important to keep the complexity in balance to keep the risks low.

In the empirical study of the implementation of information systems in a rural context which covers both the introduction computers and internet in five rural towns as a tool for collaboration and sharing information, and the work to ensure equal access to internet services by developing an local access networks for broadband access in two rural communities. The studies provide varying factors contributing to the development, these have been summarised in the conceptual framework in Figure 17. These varied concepts deepen the understanding of the complexity of bottom-up development of information infrastructures in rural areas.

Still this work is based on a specific context, it can be a reason to ask whether the result is transferable to other contexts. It is my belief that it is transferable, but the implementations can not be a blueprint of another process, it needs to be fitted to the new context. The general concepts given in Figure 17 can be used independent of context. Primarily it is transferable to information infrastructure cases in other rural areas that are to another context with many of the same characteristics. Secondly, I think it will also be transferable to developing countries, but that would need to be explored further. In developing countries the available resources are often even more scare the in the rural communities involved in empirical material of this thesis, an examination of the institutional capacity may therefore uncover important resources for a development, the same goes for the descriptive clusters, exploring the installed base as part of the process. Thirdly, also in urban areas it is important to keep the institutional capacity and the site of implementation (descriptive clusters) in mind when initiating a new project, the conceptual framework may also have validity in that context, but that would need to be explored further.

One of the limitations to the thesis is related to my role in the process. In the BookTownNet case, which was an action research project completed before the work on the thesis started, I had a number of roles, as project manager, as researcher, and as technician when needed. The work in this thesis is exploratory and interpretative; it is based on the experience and the documentation from the projects, supplemented by some additional data collection in form of unstructured interviews with selected individuals in the project. These materials are the basis for the interpretative analysis, the sense making to derive concepts and contributions toward a theory on information infrastructures development and the rural counter network to respond to such challenges.

In the broadband development study, one limitation is that we have not compared the two experiences in the Sogn & Fjordane region with that of other regions in Norway or with international examples. At the same time among the twelve initiatives in the region the two were not randomly selected, but chosen because we based on the available information seemed to represent the extremes. Firdanet was one among several in a similar situation which had a seemingly weaker institutional capacity, while the other case Kapasitetslaget had a strong institutional capacity in that it included the college and research institute with many years experience in developing and operating broadband infrastructure. This was

done to maximise the information at the same time as the number of samples were kept low (Flyveberg, 2006), at the same time as there were significant differences, both with regard to type and size of user groups, budget and organisation.

I will argue that the thesis makes a contribution to knowledge and understanding of the contextual factors which influence the introduction of information infrastructures in a rural context. The main location under study have been in the region Sogn & Fjordane in Norway, but in the first two studies there have also been comparisons with other rural settings in France, Belgium, the Nederland's, Wales, Finland and Italy. The thesis is interesting in that it draws on an empirical setting studying different implementations of information infrastructures in rural areas, and is providing a conceptual framework which is trying to give a broad but specific representation of the complexity involved.

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Appendix A

Ingjerd Skogseid & Arild Jansen

Booktowns on the Internet: Rural Enterprises Enter the Network Society.

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BOOKTOWNS ON THE INTERNET: RURAL ENTERPRISES ENTER THE NETWORK SOCIETY

Ingjerd Skogseid
Western Norway Research Institute
ingjerd.skogseid@vestforsk.no

Arild Jansen
Western Norway Research Institute and
Finnmark College
arild.jansen@vestforsk.no

Abstract

This paper reports on a project aimed at revitalizing small and old rural villages through establishing a network of bookshops, the BookTownNet. The project combined a research framework based on theories from information system research and regional economics in analyzing the development and diffusion of information and communication technology (ICT) to small, rural enterprises through that network. Our findings indicate that use of the Internet both locally and between the booktowns has strengthened the communication and collaboration between them, thus creating a better basis for the small bookshops to be competitive in the information society. Further, we have found that differences in local innovation systems to some extent have influenced the diffusion processes. Our data also show that the booktown network has been able to compensate for the lack of support in the regional innovation system, which makes the importance of the ICT-based virtual network spanning geographically distributed regions evident. This indicates that the booktown infrastructure and support system has been the most important factor in the bookshops' ability to implement and use the new technical solutions.

Keywords: Information systems, innovation, diffusion, infrastructure, virtual organizations, small rural organizations.

INTRODUCTION

The story behind this paper dates back to the early 1960s, when the young Richard Booth founded the worlds first Booktown in the small Walesian rural village Hay-on-Way, threatened by economic decline and migration. His idea was to turn this depression to revival by selling second-hand and antiquarian books. Initially, nobody had faith in the idea, but during the 40 years since he started, the idea has spread all over Europe, and a number of booktowns play a significant role in their local economies.

Today, however, the new economy based on information and communication technology (ICT) and in particular the Internet represents a new challenge for the old-fashioned bookshop. To face these challenges, the representatives of five booktowns took an initiative to create a project that would strengthen the bonds between the bookshops and booktowns, a *Booktown Network*. The aim was to establish an ICT infrastructure to support an organizational network between the booktowns, which allow both the bookshops and the booktowns to have a common communication channel between each other and also to the wider Internet audience.

This paper reports on that the work, and aims at explaining the key factors which have contributed to the rather successful development of the Booktown network. The specific objective of this study was to understand the role of the ICT infrastructure as part of the regional innovation systems and how they have supported the diffusion processes in the individual enterprises.

The structure of the paper is as follows. The following section describes the theoretical background. Our research framework and method are then presented. In the final section, we describe and analyze the empirical case.

THEORETICAL BACKGROUND

Our focus is on information and communication technology (ICT) systems and adoption in organizations, in particular in a regional and local context. This research approach requires that we combine theories from the fields of regional economics, innovation/diffusion theory, and information systems (IS) research. While the IS literature can help us understand how organizations are implementing and adapting ICT systems, theories from regional economics and innovation/diffusion theory may contribute the explanation of what characteristics of regional economies seem most important in explaining different diffusion patterns.

Regional Economies and Innovation Systems

It now seems widely accepted that the linear innovation and diffusion model, which dominated for a long time, is too simple (see Lundvall 1992; Malecki 1991; Rogers 1995). Various research has indicated that such processes are influenced by a number of factors, both at a micro and at more aggregate levels. The term *regional innovation systems* has thus been introduced to explain part of this complexity. The main characteristics of the regional innovation systems, as defined through evolutionary research in the field of regional economics (Morgan 1997) are learning and innovation, both individual and collective innovations. Collective innovations are seen as interactive processes where the firms' networks are important aspects of their collective innovative capability. This term captures the trend to build regional organizations and networks to strengthen the innovation capability of enterprises (Cooke 1998). It also includes collaboration of innovative activities (knowledge development and diffusion) between enterprises and knowledge organizations such as research institutes, colleges, libraries, and consulting companies in the region (Asheim and Isaksen 1997; Lundvall 1992; Smith 1997). Results from studies show that the innovative capabilities of enterprises are highly dependent on their ability to come in contact and cooperate with other actors, such as customers, suppliers, and research and development (R&D) organizations (Gregersen and Johnson 1997).

Technology has only recently been considered as a distinct factor in regional economics, as Storper (1997) observes. He explains an innovation system as a multi-layered structure including technologies, organizations, and territories. In this structure, technological change is recognized as one of the principal drivers in changing territorial patterns of economic development although in the social context, which is also emphasized by others (e.g., Asheim and Isaksen 1997; Smith 1997). The organizations are not only dependent on territorial contexts of physical and intangible inputs, but they have greater or lesser proximity to each other. The innovative activity is seen as partly a local and regional phenomenon that represents a new theoretical understanding of how the innovation processes occur. An understanding, concretized in the interactive innovation model (Asheim and Isaksen 1997; Isaksen 2000), defines innovations as interactive, non-linear knowledge development and transfer: technology and knowledge flows freely between R&D activities, the industry, and other stakeholders.

Healey et al. (1999) offer a framework based on the interaction between external pressure and local institutional capacities, knowledge, relational resources, and mobilization capability.
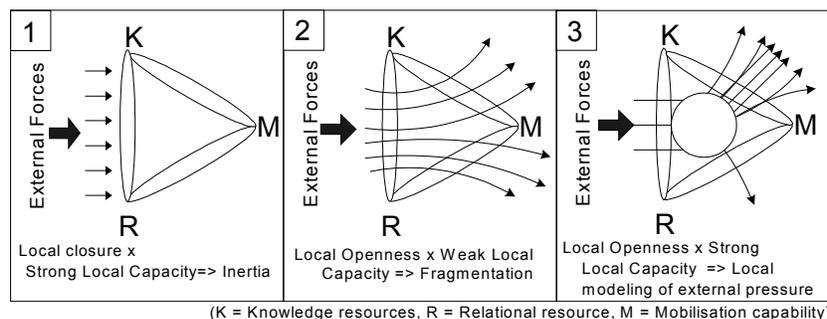
(K = Knowledge resources, R = Relational resource, M = Mobilisation capability)

Figure 1. Three Alternative Scenarios Describing How External Challenges or Forces are Managed in a Community and How the Institutional Capital Influences the Outcome of the Modeling Process (Modified from Healey et al. 1999)

Healey et al examine the factors that enable a region to make a break from the earlier path-dependent trajectory. They suggest that when communities are facing new external challenges, there are three alternative scenarios. Institutional capital can be developed to enable regions to allow local initiatives to be "shaped by powerful external forces, can mobilize and transform inherited traditions and practices and thereby shape the futures of localities in ways which enhance quality of life, the business environment and environmental quality in socially-just and inclusive ways" (Healey et al. 1999, pg. 10). The communities can reject the challenge but with the risk of *inertia* (Figure 1.1), or the technology prone communities can start to use it with the risk of *fragmentation* (Figure 1.2), or the communities can mobilize their initiative to *model the external pressure* to suit their own needs (Figure 1.3). To be able to make a change in the path dependent trajectory, the three components—knowledge, relational resources, and mobilization capability—need to be strengthened.

IS Diffusion and Adoption

While the regional economics literature traditionally viewed technology as a generic factor, our focus is to study how the specific characteristic of distinct technical systems and infrastructures influence the implementation, adoption, and adaptation of ICT-based systems (IS) in organizations. Our point of departure is that the outcome of IS implementations is dependent upon both characteristics of the technical solutions as well as the system development processes and various organizational and contextual factors (see Damsgaard et al. 1994; Kraemer et al. 1989; Larsen and MacGuire 1998; Lyytinen and Damsgaard 1998). There are a number of studies on IS diffusion to small organizations that emphasize the characteristics of the software (e.g., Cooper and Zmud 1990; Gross and Ginzberg 1984; Kwon and Zmud 1987; Lees 1987), as well as the quality of the infrastructure and support systems (e.g Heikkilä et al. 1991; Janson and Subramanian 1996). This seems particularly important for IS diffusion in small, rural enterprises lacking the necessary competence and resources (Igbaria et al. 1997; Jansen 1998a).

Traditionally, developing and using ICT infrastructures has been regarded as a predominantly technical endeavor. There is now an expanding body of literature addressing issues of a social, economic, or institutional nature. Recent research emphasizes the importance of understanding the infrastructures as multi-layered systems including technical, organizational, and human components and their ability to support various types of inter-organizational structures, both horizontal and vertical networks (Ciborra and Hanseth 1998; Monteiro and Hanseth 1995; Rolland and Monteiro 2001).

RESEARCH FRAMEWORK

To summarize the discussion, we see IS diffusion into organizations as innovations dependent on the technical solutions, the organizational characteristics, and the environment—that is, the existing innovation system along with the technological infrastructure.[1] In our particular perspective, we emphasize the quality of the technical and organizational infrastructure that may support the implementation, adaptation, and use of such an information system in the individual user organizations. Based on these assumptions, we have developed a research framework that has been applied in the analysis of some empirical cases (Grøtte et al. 2000; Jansen 1998b). Our framework distinguishes between (1) the external environment, (2) the regional innovation system,[2] and (3) the individual organizations where innovations take place. Furthermore, we include characteristics of the current technologies being diffused and used by regional organizations. Below is a short description of the different components:

- *The regional innovation system*, which we assume has different components, including:
  - *The regional/local ICT infrastructure*: the physical data and telecommunication network, and the organizational resources that support the operation and use of the technical elements. The regional infrastructure is partly integrated in the national infrastructure, but may also include additional regionally located facilities and services.
  - *Institutional capital*: the general ability to handle innovation and change, including knowledge, relational, and mobilization resources, entrepreneurship, norm's and attitudes in the region, etc.

- *Organizations*, where the information systems are being diffused and used, and which are supported by of the infrastructure. These may be public or private organizations, described by the internal characteristics and their inter-organizational relations.

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[1]The distinction between the regional innovation system and the ICT infrastructure may not be clear, as we define the infrastructure to include the parts of the innovation system that support the IS acquisition, adoption, and adaptation processes.

[2]In this paper, a region is defined as a distinct area, such as a village, town, or community.

The main focus is on factors that we assume are relevant for managing the technology, such as previous ICT experience and competence. The organizations may be linked together in organizational networks, where they exchanges ideas, information, knowledge, norms, etc., and in that way stimulate innovative activities.

Outside the region or local community we assume that there is an external environment which influences regional innovation system through two important processes:

- *Economic and social change forces*: the external pressure that causes changes in local industries and related economic matters, including market relations.

- *Technical development and diffusion*: the development of distinct ICT systems and solutions, and the diffusion of such systems to regional or local organizations. These systems will be characterized by their functionality, technical qualities, usability, etc., related to the specific user domain.

These distinctions permit us to organize our work around a framework with an overall structure, illustrated in Figure 2.
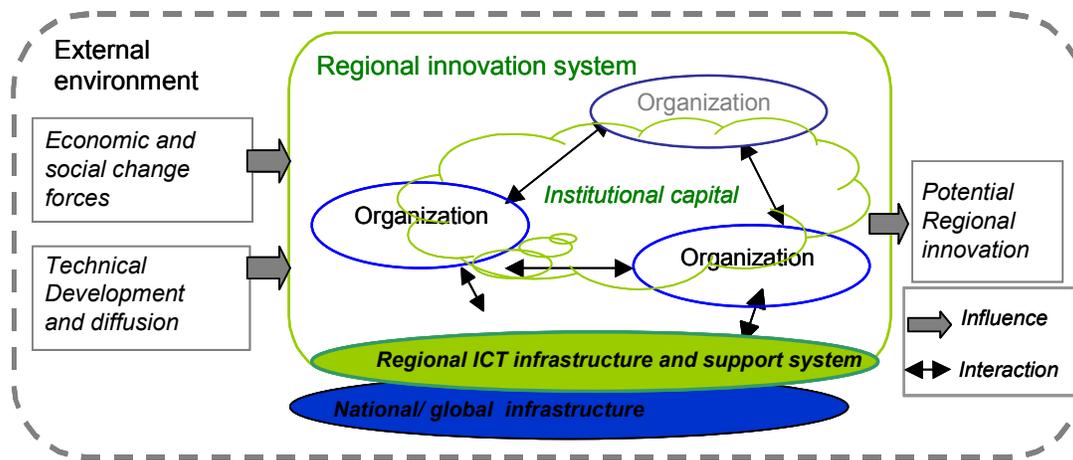
Figure 2. Research Framework

The intention behind this framework is to illustrate how external forces causes the diffusion of new technology into a local community, which may eventually result in a local innovation.

Research Issues

The general framework depicted above is rather open. Our specific aim is to examine how factors such as organizational and inter-organizational characteristics and the infrastructures affect the adoption and use of distinct ICT systems in small rural organizations. In particular, we will address the following issues:

- What type of diffusion patterns can be identified in the network?
- What type of support was required most from the innovation systems and the infrastructures?
- What has been the role of the technology in the establishment and growth of the organizational network, e.g. in changes in communication and collaboration activities?

RESEARCH METHOD

This research study is based on an analysis of five booktowns that were particularly involved in developing the ICT network and the organizational structure: the Booktown Network. This approach is situated within the interpretative strand of information systems research (Walsham 1995), with the aim of doing a more in-depth analysis of the history of the case. It is, furthermore,

a participatory action research, as one of the authors of this paper had an active role as project manager in the project part of the development.   In that respect, the author has been involved in most aspects of the project.

The empirical data was collected over a five-year period, with two years being more active than normal because of the collaborative project between the five villages. Our unit of analysis is the 17 units comprising the 13 bookshops and four booktown associations that have been active in the collaborative project. The main methods for data collection have been project documentation along with semi-structured and free interviews and questionnaires that have been conducted during the analysis of user needs and as a part of the in-project evaluation. These have been conducted at regular intervals during the design, implementation, and testing of organizational and technical solutions supporting the network. In total, 61 interviews with about 30 different people have been carried out. About 200 Internet users have responded to surveys administered through the Internet. The results of these interviews and surveys have been documented in prior research (Alford and Seaton 1999; Seaton 1998; Seaton and Alford 2001; Skogseid and Seaton 1998).

CASE DESCRIPTION AND DISCUSSION

In this section, we will first give a description of the case and then discuss it with regard to the theoretical contributions.

BookTownNet: A Network between Five European Booktowns

The booktown phenomenon has developed from the estblishment of the first booktown 1962 in Hay-on-Wye (Seaton 1996) on the border between England and Wales up to the present, where almost 30 booktowns have been established world-wide and several are under development. Most booktowns developed in villages of historic interest or of scenic beauty. This means conservation of the cultural heritage, as well as retaining the unique atmosphere. As the number of booktowns increased, the need for more and better communication between the villages also increased. In 1996, five of the villages decided to establish an organizational network. In addition to Hay-on-Wye, the four other villages are Bredevoort (NL), Fjærland (NO), Montolieu (FR), and Redu (BE). The villages have a population of between 300 and 1,600, between 12 and 36 bookshops, and up to 500,000 visitors in a year. In the individual villages, the relationship between the bookshops is characterized both by a high degree of collaboration in developing the village and attracting visitors and a high degree of competition in selling most books. This is also mirrored across the villages: they see the benefit of working together as a "global village" at the same time as they individually want to attract the most visitors. They have thus identified different communication needs:

- *Communication between bookshops:* The success of a booktown is first and foremost a question of successful book trade. Many bookshops recognize that the future success of their business requires international specialization and a closer communication between the individual bookshops independent of location.

- *Communication between booktowns*: Booktown associations[3] and enterprises have individual strengths and weaknesses, and the participants in the BookTownNet were interested in improving booktown quality by effective communication of information and ideas between villages. The booktowns constituted a European-wide network with great potential for cultural inter-linkages, which would promote traffic between the villages.

- *Market communication:* Although the booktowns are different, they are characterized by a common atmosphere that the visitors find particularly attractive. Presenting information about the booktowns by way of a common IS were seen as important.

The Technical Solution

As more and more books are being sold on the Internet, the villages are facing a continued threat of marginalization. Developing an efficient ICT-based information and communication system between bookshops was seen as necessary. Five application areas were defined:

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[3]A booktown association is a local business and community interest organization for the bookshops in each booktown.

- Wholesale of books between book selling enterprises within and between booktowns.
- The establishment of an international network (virtual booktown organization).
- Marketing the booktown network as a pan-European tourist trail.
- Specialized global marketing of high value book items.
- Information about activities in the booktowns to the global book-lovers community.

The application areas were divided in two distinct components: (1) a closed intranet for dialog and communication between users tied to the participating booktowns and (2) an open Internet for communication with worldwide Internet users. The intranet application was set up to facilitate communication and collaboration between bookshops within and between the different booktowns, and for maintaining the information on the Internet site.

The information presented on the Internet belongs to three categories: (1) general information about the booktown movement, (2) information about the individual booktowns, and (3) information about the individual bookshops. Initially other services were envisaged, but they were prioritized away and other services were tested and not found useful.

The Infrastructures and Innovation Systems

In terms of the research framework presented in Figure 2, the local innovation system comprises the bookshops, the booktown associations, public administration, local computer retailers, and other support organizations of various type and quality. In one village, the local public administration was counterproductive for the development of the booktown. In several of the booktowns, the only available local support system is the booktown association. In different villages, the booktown associations have different roles. In some villages, they are a more strategic, political organization. In other villages, they carry out a number of functions to the common good of the bookshops and have also been the impetus for introducing computers in the bookshops. However, our data show the booktown network has been able to compensate for the lack of support in the regional innovation system, which makes evident the importance of the ICT-based virtual network spanning geographically distributed regions.

The five different villages have been allowed to choose their own local diffusion strategy. In some villages, only the project partners were included. In other villages, other bookshops were offered access to the intranet services. It was a conscious choice on behalf of the project to let each village choose how they diffused the tool to potential users. The assumption was that the local partners know their colleagues best, e.g, same culture and language. In some of the booktowns (Fjærland, Montolieu, and Redu), all of the bookshops and other related organizations have been given access. In another villages (Bredevoort and Hay), they did not want to let other bookshops become users before the project phase had concluded.

These different strategies have, accordingly, implied that the number of users and usage patterns vary between the booktowns. So far it seems that the "open and including" strategy has been more successful than the other in that they involve more users in the villages and are introducing the Internet to more bookshops. In this way, they have a larger "testing community" and in general they have increased the ICT competence in the community. We find that, to some degree, these booktowns collectively correspond to the *local modeling scenario* as illustrated in Figure 1 in the way they have handled the information technology challenge. Those who chose an alternative, more excluding strategy argued that it would be more appropriate that a select group of more motivated and competent users test the prototypes before they are made generally available to the bookshops. However, so far they have not succeeded in spreading the technology. This seems to correspond to the *fragmentation* scenario.

During the project phase, the project organization developing the ICT applications was also an important part of the support system, although in a more virtual sense in that help and guidance was given electronically. The intranet makes up a common infrastructure independent of geographic location. The common ICT platform is, in this way, an infrastructure that supports three types of networks:

1. Network between local bookshops (within a village)
2. Network between booktowns (bookshops and associations)
3. Network between Internet users/customers and the bookshops

The actors in this case have been the bookshops and the booktown associations; they have both taken the initiative with the project and participated in the development of the infrastructure.

The in-project evaluations (Alford and Seaton 1999; Seaton and Alford 2001) show that the bookshop users gained confidence and knowledge in using the ICT-based tools, and that the use of ICT-based tools in the bookselling business increased. In particular, three activities showed a high score in the evaluation carried out at the end of the project. The internet part of the system seems to have been serving its function, while the Intranet part of the service has not yet fulfilled its purpose in the network. There are several reasons for this. First, the amount of communication is not sufficient in volume and regularity to make the users access the site, which is the typical problem of the critical mass of users: more users are needed to make the intranet interesting. Second, in the initial phases of the project, an additional e-mail service was established as the main communication channel, which many of the users felt was sufficient for communication, even after the intranet was made available. Furthermore, the usability of the intranet has been criticized for not being sufficiently tailored to the user requirements.

Organizations and Network

The booktowns and the bookshops in the villages are members of several networks; the networks partly overlap and have common nodes. In each village, we find an *intra-town* network, which then is linked together in the *inter-town* network. In addition there is the network established as a part of the project. These networks can also be seen as one, where parts of the actors in the network have started to change and increase in number, but that have not stabilized yet.
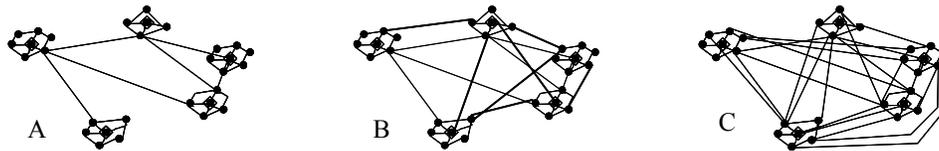

Figure 3. Pre- and Post-Situation for Communication In and Between the Villages.
The circles represent the intra-town networks and the lines the communication patterns.
The development from situation A to C represents an increase in number
and communication links and frequency.

Establishing a bookshop in an existing booktown automatically makes you a member of the intra-town network, and if the village also has a connection to one of the other booktowns, then the bookshop can more easily hook up to the global network of booktowns (inter-town network). The communication channels used in these network are mainly the *traditional medium* such as face-to-face dialogs, telephone, and fax, from about 1996/1997 there was also some use of e-mail. Communication between the villages is primarily between a few individuals and is not very frequent. Between some of the villages the contacts were more frequent than between others. Figure 3.A is an illustration of this network. In terms of our research framework, this network is part of the local *innovation system* in each village. All of the booktowns have been developed based on the ideas gathered from the other villages and Hay-on-Wye. In this way, knowledge has been transferred from one village to another and the links between the villages have been established. Some links are stronger and more frequently used; others are not maintained and will eventually be lost.

Figure 3.B is an illustration of the second inter-town network that was the result of the project phase of the development, the BookTownNet project, and a result of the introduction of technology in the booktown setting. In this process the network has slowly been extended and is taking over from the "old" network. This has made communication easier and has made more open and interactive dialog between members in the network possible. Figure 3.C illustrates the development that has been taking place since the project ended. New members are joining the network, coming from the initial five villages but also extending outside this group, and an additional 11 booktowns have signed up to join the network, which is now managed by a new *International Organization of Booktowns*.

CONCLUSIONS

Our findings indicate that the use of Internet, both locally and between the booktowns, has strengthened the communication and collaboration between them, thus creating a better basis for the small booktowns to be competitive in the information society. Furthermore, our data show that the booktown network has been able to compensate for the lack of support in the regional

innovation system, which makes evident the importance of the ICT-based virtual network spanning geographically distributed regions. This indicates that the booktown infrastructure and support system has been one of the most important factors for the bookshops to implement and use the new technical solutions. We find that the analysis of the BookTownNet shows that our framework is applicable to cases that span distinct geographic regions.

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Arild Jansen & Ingjerd Skogseid

Book towns and the network society: new perspectives on developing rural enterprise.

Book towns and the network society:
new perspectives on developing rural enterprises

Arild Jansen* and Ingjerd Skogseid**

*   Western Norway Research Institute and University of Oslo, Norway

** Western Norway Research Institute, Norway

arildj@ifi.uio.no and ingjerd.skogseid@vestforsk.no

Mail addresses
    Arild Jansen,
       Department of Informatics,
       University of Oslo,
       PB 1080, Blindern,
       Oslo 3,
       Norway

    Ingjerd Skogseid I
       Western Norway Research Institute
       Postboks 163
       6851 Sogndal
       Norway

Book towns and the network society:
New perspectives on developing rural enterprise

Abstract. This paper reports from the BookTownNet project which involved five rural villages. Facing the threat of marginalization, they established the Book Town network and developed an Internet based infrastructure to support a network organisation. We find that the use of the Internet both locally and between the book towns has strengthened communication and collaboration, whereby creating a better basis for the small bookshops to be competitive in the information society. Our data indicates that although the Book Town infrastructure and support systems have been important for the bookshops ability to implement and use the new technical solutions, this has been insufficient for stimulating the organisational changes in all book towns. Therefore it would seem that the characteristics of the regional and local innovation systems have had a greater impact in stimulating organisational innovations than external, ICT-mediated support, at least in a short-term perspective.

We believe that these findings are relevant for similar efforts in building networks between small enterprises, also in developing countries. This implies that one should give priority to strengthening the local innovation system through interplay with the technical infrastructure and the local institutional capacity.

Keywords: information systems, innovation, diffusion, infrastructure, network organisations, small rural enterprises

1 Introduction

The story behind this paper dates back to the early sixties, when the young Richard Booth founded the world's first 'book town' in the small Walesian rural village Hay-on-Way, threatened by economic decline and migration. His idea was to turn this depression to upheaval by selling second-hand and antiquarian books. Initially, there was little faith in the concept, but during the 40 years since, the idea has spread throughout Europe, and an increasing number of book towns play a significant role in their local economies.

Today, however, the new economy based on information and communication technology (ICT) and in particular the Internet represents a new challenge for the traditional bookshop. To face these challenges the representatives of five book towns took an initiative to create a project which would strengthen the bound between the bookshops and book towns, the *Book Town network*. The aim has been to establish an ICT infrastructure that would support an organisational network between the book towns, which provides the bookshops in the book towns with a common communication channel between each other and also offers access to the wider Internet audience.

The focus in this paper is to study how such small enterprises and the corresponding local economies have risen to meet the challenge of the network society. Departing from Castells'

(2000a) notion of the network enterprise, supplemented with elements from innovation theory, we are analysing the experiences of building the Book Town network. We believe that the many lessons learned from these efforts can be applied in building similar networks between small businesses in developing countries.

The structure of the paper is as follows. Chapter 2 and 3 describe the theoretical background, research issues and research method. In chapter 4 we describe and analyse the empirical case, with the conclusion in chapter 5.

2   Theoretical background

Manuel Castells, in the first book of his trilogy, claims that the new economy that is growing out of the information technology revolution is said to be *informational, global and networked* (Castells 2000a). The new economy is informational because "the productivity and competitiveness of units or agents in this economy … fundamentally depend on their ability to generate, process and apply efficient knowledge-based information". It is global because "the core activities of production, consumption, and circulation, as well as their components (…) are organized on a global scale, either directly or through a network of linkages between economic agents". The new economy can be referred to as networked because its productivity is generated through and competition is played out in a global network of interaction between business networks (Castells 2000a, p.77).

Castells argues that we see new modes of development that relate the way we use technology to improve efficiencies in production. The informational mode of development is "flexible, pervasive, integrated and reflexive rather then additive evolutionary" (Castells 2000b). Reflexivity refers to the speeding-up process of innovation because both raw materials and end products are information, which is easy to feedback to the production process, to improve the product in the next phase. This reflexivity is the basis for an informational and global economy. The result of this is a restructuring of all economic activities into a new mode of production. This informational mode of production is a challenge for rural regions to cope with. Important factors are access to information and processing capability. Processing capability may become a challenge if the "brain drain" continues, this is also affected by the more immediate problem of access to an adequate infrastructure which is crucial for the enterprises ability to participate in the network society" (Jansen 1998).

Further, Castells claims that although the economy is global it is distributed asymmetrically, and it is the "traditional" western countries that are driving the development. Large areas and population groups are excluded, while at the same time the development of the new economical paradigm is affecting all groups directly or indirectly (Castells 2000a). This fundamental asymmetry affects the level of integration, the competitiveness and the ability to benefit from economic growth. To avoid marginalization it is particularly important for rural areas to stay abreast of the development of this new type of society.

Castells claims that the rise of the informational, global economy is characterised by the development of a new organisational logic, which however manifest itself under different forms in various cultural and institutional contexts (op cit. p 164). The first form has been the move from mass production to flexible production. A second form is the crisis of the large corporation, and the resilience of small and medium firms as agents of innovation and sources of job creation. The networking structure can be a mix of vertical and horizontal; it is vertical through subcontracting relations between a central coordinating enterprise and the SME that make up the production and distribution channels. It is horizontal if there exists independent networks between the sub-contracted enterprises in a broader sense than through

the sub-contracting network. In these kinds of networks the enterprises can be distributed independent of the location of the other enterprises in the network (Castells 2000b).

Another form of organisational flexibility can be seen in multidirectional network models enacted by SME and large corporations alike. In these networks enterprises seek collaboration with similar enterprises, where no single enterprise leads the network; instead it is a flexible structure where closer alliances are made on a project basis between the enterprises. In this way they may establish themselves in a market niche and gain competitive advantage.

Castells discusses different trends that are occurring in parallel and interact and influence each other, even though they are independent of each other and along very different dimensions. However, the crucial point is that "networks are the fundamental stuff of which new organisations are and will be made" (Castells 2000a, p180), and they have the potential to expand and integrate enterprises both locally and globally.

2.1 Research Issues

While Castells primarily discusses innovations in networks at a macro or global level, our focus is at a micro level. We are studying the development of a small-scale network between rural enterprises. This implies both technical and organisational innovations that require various type of support. In traditional regional economics and innovation theory, the term *regional innovation system* has been introduced to explain part of this complexity. The main characteristics of the regional innovation systems, as defined through evolutionary research in the fields of regional economics, are learning and innovation, both individual and collective innovations (Morgan 1997). Collective innovations are seen as interactive processes where the firms' networks are an important part of their collective innovative capability. This term captures the trend to build regional organisations and networks to strengthen the innovation capability of enterprises (Cooke 1998). Results from studies show that the innovative capability of enterprises is highly dependent on their ability to come in contact and co-operate with other actors, such as customers, suppliers and R&D organisations (Asheim and Isaksen 1997; Lundvall 1992; Smith 1997). The innovative activity is seen as partly a local and partly a regional phenomenon. This represents a new theoretical understanding of how the innovation processes occurs, and is concretised in the interactive innovation model (Asheim and Isaksen 1997; Isaksen 2000), which defines innovations as interactive, non-linear knowledge development and transfer: technology and knowledge flows freely between R&D activities, the industry and other stakeholders.

Based on this interactive innovation model we have developed a research framework that includes the external environment, the regional innovation system and infrastructure, and the individual organizations where innovations take place (Jansen 1998b, Grøtte et al. 2000). This framework has been applied in the study of some regional development initiatives; among them the Book Town network (Skogseid and Jansen 2001).

Our aim in this paper is to analyse some of the challenges in building this type of small-scale 'virtual' enterprise network, which span different regions. We combine Castells' notion of the network enterprise with elements from the innovation theories discussed above. In particular, we will address the following questions:

- Which types of support seem to have been most important in developing and implementing organisational networks between small, rural businesses?

- What type of relations can be identified in such networks, and what type of different interest has been voiced?

- What types of interaction patterns are going on in the network, and how do these strengthen the network organisation?

3 Research Method

This research study is based on an analysis of the five book towns that were directly involved in developing the ICT network and the organisational structure: the Book Town network. This approach is situated within the interpretative strand of information systems research (Walsham 1995), aiming at doing more in depth analysis of the history of the case. It has some of the characteristics of action research, as one of the authors has had an active role as project manager in the project, and has been involved in most aspects of the project. She has been involved in problem definition and requirement specification as well as in the design and implementation work and the final evaluation, corresponding to Baskerville's diagnostic and therapeutic stages (Baskerville 1999). This work has been carried out in close co-operation with the future users; the bookshop owners, book town association representatives and other stakeholders, as the aim of the project has been to link theory and practice (Baskerville and Wood-Harper 1998).

The empirical data has been collected during a five-year period; in two of these the activity was much higher due to the collaborative project between the five villages. Our analysis is based on the 17 units comprising the 13 bookshops and four book town associations that have been active in the collaborative project. The main methods of data collection have been project documentation along with semi-structured and free interviews and questionnaires which was conducted at regular intervals as part of the analysis of user needs and the in-project evaluation, during the design, implementation and testing of organisational and technical solutions. In total 61 interviews with 30 different persons have been carried out. Over 200 Internet users have responded to surveys administered through the Internet. These are documented in Skogseid and Seaton (1998), Alford and Seaton (1999), Seaton (1998) and Seaton and Alford (2001).

4 Case description and discussion

In the following section we will firstly give a description of the case and then discuss it with regard to the theoretical contributions.

4.1 BookTownNet – A network between five European book town's

The book town phenomenon has developed from the first book town established in 1962 in Hay-on-Wye (Seaton 1996) on the border between England and Wales, and to date almost 30 book towns have been established worldwide and several are under development. Most book towns exist in villages of historic interest or of scenic beauty, allowing for the conservation of the cultural heritage coupled with retaining the unique atmosphere. As the number of book towns increased, so did the requirement for more and better communication between the villages. In 1996 five of the villages decided to establish an organisational network. In addition to Hay-on-Wye, the four other villages are Bredevoort (NL), Fjærland (NO), Montolieu (FR) and Redu (BE). The villages have a population of between 300 and 1600,

including between 12 and 36 bookshops and up to 500 000 visitors in a year. In the individual villages the relationship between the bookshops is characterised both by a high degree of collaboration in developing the village and attracting visitors combined with competition in selling most books. As increasing numbers of books were being sold on the Internet, each village was facing the threat of marginalization. They saw benefits of collaborating as a "global village", while simultaneously trying to attract most visitors to their own town. They have thus identified different communication needs, these being:

- *Communication between bookshops:* The success of a book town is first and foremost a question of successful book trade. Many bookshops recognise that the future success of their business requires international specialisation and a closer communication between the individual bookshops independent of location.

- *Communication between book towns*: Book town associations[1] and enterprises have individual strengths and weaknesses, and the participants in the BookTownNet were interested in improving book town quality by effective communication of information and ideas between villages. The book towns constituted a European-wide network with great potential for cultural inter-linkages, which would promote traffic between the villages.

- *Market communication:* Though the book towns are different, they are characterised by a common atmosphere that the visitors find particular attractive. Presenting information about the book towns by way of a common IS were seen as important.

Thus, developing an efficient ICT-based information and communication system was seen as necessary. The system consists of both an intranet and Internet applications. Five application areas were defined:

- Wholesale of books between book selling enterprises within and between book towns

- The establishment of an international network (the virtual Book Town organisation)

- Marketing the book town network as a pan-European tourist trail

- Specialised global marketing of high value book items

- Information about activities in the book towns to the global book-lovers community

The application areas were divided in to two distinct components, i) an Intranet for dialog and communication between users participant, and ii) an Internet web site for communication with external users. The Intranet application was developed to facilitate communication and collaboration between bookshops within and between the different book towns, and for maintaining the information on the Internet site.

The information presented on the Internet belongs to three general categories, i) general information about the book town movement, ii) information about the individual book towns and iii) information about the individual bookshops. Initially other services were envisaged, but later they were prioritised away or they were developed and tested and deemed not useful. The common ICT platform is an infrastructure that supports three types of collaboration patterns:

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[1] A Book Town association is a local business and community interest organisation for the bookshops in each book town.

- Collaboration between local bookshops (within a village)

- Communication and business-related transactions (between the book towns' bookshops and associations)

- Information exchange between users/customers and the book shops

The actors involved are both the bookshops and the book town associations; they have both taken the initiative to the project and participated in the development of the infrastructure.

Innovative activity
The Book Town network appears to fit into Castells' framework. It is becoming *global*; currently the network spans many countries in Europe. It is *informational* in that the network supports various kinds of information and knowledge exchange. It is truly a *networked* organisation.

Furthermore, Castells claims that working in networks strengthens the innovative capabilities of the individual participants. In the Book Town network, we have identified different patterns of innovative activities. The project itself has clearly been an innovative activity, including both technical and organisational challenges, the project network offered substantial support in developing and implementing the technical solutions, and these have been rather successful. The in-project evaluations (Alford and Seaton 1999; Seaton and Alford 2001) show that the bookshop users have gained confidence and knowledge in using the ICT based tools, and there is also increasing usage of ICT in terms of the bookselling business. The Internet part of the system seems to have been serving its function, while the Intranet part of the service has had limited success. There are several reasons for this: firstly, the amount of communication was insufficient in volume and regularity to encourage users to access the site, which is the typical problem of gaining critical mass of users: increased usage is needed to make the Intranet interesting. Secondly, in the initial phases of the project, e-mail was provided as the main communication channel, which many of the users felt was sufficient for communication. Furthermore, the usability of the Intranet has been criticised for not being sufficiently tailored to the user requirements. Part of the problems seems to be related to organisational matters.

What has the role of the local environment been? According to regional economic theory, the local innovation system comprises the 'network' of relevant resources, in our case the bookshops, the book town associations, public administration, local computer retailers and other support organisations. We found that these were of various type and quality throughout the different book towns, related to resources, competence and attitudes. In some of the book towns the only available local support system was the book town association. These book town associations have different roles. In some villages they are a more strategic, political organisation. In one village the local public administration was unsupportive towards the development of the book town, and the development efforts were left to their own initiative. In other villages, however the association carried out a number of functions to the common good of the bookshops and have also been the driving force in introducing computers in the bookshops.

The five villages have been allowed to choose their own local diffusion strategy. In some of the book towns (Fjærland, Montolieu and Redu) all bookshops and other related organisations have been given access. In other villages (Bredevoort and Hay), only the

project partners were included, and they did not want to let other bookshops become users before the project phase had concluded. Within the project it was a conscious decision to allow each village to choose how they diffused the tool to potential users. The assumption being that the local partner's best knows their colleagues, e.g. same culture and language.

These individual strategies have led to differing numbers of users and usage patterns across the book towns, this far it seems that the "open and including" strategy has been more successful both in involving more users in the villages and in introducing the Internet to more bookshops. They have a larger test bed and in general increased the ICT competence in the community.

Those who chose the more exclusive strategy argued that it would be more appropriate that a selected group of more motivated and competent users tested the prototypes before they were made generally available to the bookshops. However, they have not so far succeeded in spreading the technology, which is, as least partly, an organisational challenge that therefore needs to be addressed.

Our data highlights the fact that the book town network has been able to compensate for the lack of support in the regional innovation system when it comes to resolving technical issues, which provides evidence for the importance of the book town infrastructure in supporting such activities. It appears however, that the characteristics of the local innovation system are more critical for stimulating organisational innovations, and that resources in the virtual network cannot compensate for shortcomings locally, at least in a short-term perspective.

Network organisations and interaction patterns

The book towns and the bookshops in the villages are members of several collaborative networks; which partly overlap and have common nodes. In each village we find an *intra-town* network, which then is linked together in the *inter-town* network. These networks can also be seen as one, where parts of the actors in the network have started to change and increase in number, but that have not stabilised yet.
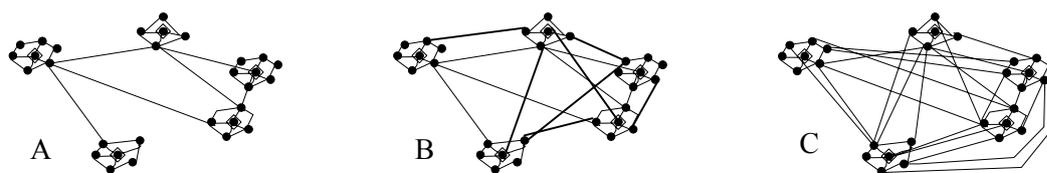
Figure 1 Pre and post situation for communication in and between the villages, the circles represent the intra-town networks and the lines the communication patterns. The development from situation A to C represents an increase in number and communication links and frequency.

Establishing a bookshop in an existing book town automatically makes you a member of the intra-town network, and if the village also has a connection to one of the other book towns then the bookshop can more easily hook up to the global network of book towns (inter-town network). The communication channels used in this network were mainly the *traditional medium* such as face-to-face dialogs, telephone, and fax; from 1996-97 there was also some use of e-mail. Communication between the villages was primarily between a few individuals and not very frequent, between some of the villages the contacts were more frequent than others, figure 1.A is an illustration of this network. In terms of our research framework, this network is part of the local innovation system in each village. All the book towns have been developed from the same concept, Hay-on-Wye, whereby knowledge has been transferred

from one village to the other and the links between the villages have been established. Some links are stronger and more frequently used, while others are not maintained and will eventually be lost.

Figure 1.B is an illustration of the second inter-town network that was the result of the BookTownNet project, and a result of the introduction of technology in the book town setting. In this process the network has slowly been extended and is taking over from the "old" network. This assisted communication and allowed for more open and interactive dialog between members in the network. This intermediate state has further developed into what's described in Figure 1.C. New members have joined the network, coming both from the initial five villages and extending outside this group, an additional eleven book towns have signed up to join the network, which is now managed by a new *International Organisation of Book Towns*. The primary aim is to support the technical infrastructure and stimulate the further development of the Book Town network. Only one of the book towns has decided to not join in the organisation.

4.2 Different relations and different interest

Important issues in the design and development of the Book Town network have been:

- *Different goals*: to develop a bookshop or to develop a book town or to develop the whole local community. There was a difference in the partners who were booksellers and those who were working actively in the book town association; the association representatives worked for the local community while the bookshop owners had the bookshop as their primary focus. Thus, the degree to which the latter acknowledged the importance of developing the community varied.

- *Decentralisation and local autonomy*. How much of the operation of the project could be decentralised? How to organise and operate the project? The project was organised in a number of activities some of these ran decentralised and some more centralised. It was important to decentralise as many activities as possible to ensure alignment of different interests. One important reason for this was the multi-lingual character of this community, as more than 5 different languages we represented. At the same time there were activities that needed to be run centrally, such as development and operation of the system.

- *E-commerce* or to stay with the traditional way of selling books. At the start of the project it was discussed to establish a "book town bookstore" on Internet, but this idea was discarded.

Some of these conflicts have been solved during the project period, but there are obviously tensions between creating a common international organisation, which may impose certain uniformity versus that of maintaining local autonomy and the cultural heritage. The basic ambition is that each book town should remain local and unique and not just become one of many nodes in a global book town network.

5 Conclusion

Our findings indicate that the establishment of the Book Town network, both individually and between the book towns has strengthened the communication and collaboration between them, whereby creating a better basis for the small book towns to be competitive in the new economy.

Our data shows that the network has been critical for the bookshops ability to implement and use the new technical solutions, which highlights the importance of the Book Town infrastructure in supporting such activities. This indicates that the Book Town network has at least partly been able to compensate for the inability of the local infrastructure and support system related to solving the technical issues. On the other hand, we find that the network has been insufficient for stimulating the organisational changes in all book towns. It seems therefore that the characteristics of the local innovation system are most important for stimulating organisational innovations than available support from outside.

The Book Town network resembles the structure of the horizontal, multidirectional network model of SME as described by Castells. It illustrates that it is possible to establish an international cooperation based on use of ICT that are spanning both geography and cultural differences. Castells claims, however, that the development of a network society is asymmetric, it does not benefit all. This seems to conform with our findings; in the Book Town network, we have experienced a difference between the actors that are participating in the changes, that are active, and the ones that the action is carried out in relation to but that does not actively participate. This is not at all surprising.

Healey et al. (1999) have examined the factors that may enable a region to make a brake from the existing, path dependent trajectory and mobilize their initiative to *'model' the* external pressure to suit their own needs. They claim that to be able to make adequate changes it is necessary to strengthen the local institutional capacities; that is both the knowledge and relational resources and their mobilization capability. Our findings clearly supports this view; in those book town where they have been able take an initiative to face the external threat they have mobilized their local resources to use new technology in a way that can help them in developing the local economy.

The Book Town network has so far resisted joining a larger corporation. Instead, it has started co-operation with one of the dominating E-book businesses, though without giving away its independence. In this way, the BookTownNet may appear as a kind of 'indigenous network' linking small rural enterprises.

We believe that these findings are relevant for similar efforts in building networks between small enterprises also in developing countries. Our case shows that it is possible to stimulate local economies through collaborate efforts based on horizontal networks between small and independent enterprises across borders and cultures. However, one should give priority to strengthening the local innovation system in order to help organisational implementation of ICT-systems in the individual enterprises. A key factor is to allow for interplay between the common network infrastructure and the local innovation system (Skogseid and Jansen 2001). Stakeholders should put effort into not only strengthening the knowledge resources, but also the relational resources and the mobilization capabilities (Healey et al 1999). It is important to develop the infrastructure as an integral part of the local innovation system, including organizational and human resources that can support collaboration between various types of enterprises locally and across the network.

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Pernilla Gripenberg and Ingjerd Skogseid, with Francesco Botto, Andrea Silli, and Virpi Kristiina Tuunainen

Entering the European Information Society: Four rural development projects

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Entering the European Information Society: Four Rural Development Projects

Pernilla Gripenberg

Department of Management and Organization, Swedish School of Economics and Business Administration, Helsinki, Finland

Ingjerd Skogseid

Western Norway Research Institute and Department of Informatics, University of Oslo, Norway

Francesco Botto and Andrea Silli

Department of Sociology and Social Research, Laboratory of Information Technology, University of Trento, Trento, Italy

Virpi Kristiina Tuunainen

Department of Information Systems Science, Helsinki School of Economics and Business Administration, Helsinki, Finland

This article compares four European information and communication technologies (ICT) development projects spawned by national and EU initiatives to create the "European information

society." These projects, which sought to support learning and better use of ICT, were all the result of opportunities opened up by political initiatives. The analysis indicates that the main problems that afflict these projects stem from varied expectations and interests of the major actors. These problems can be mitigated considerably if a feeling of ownership is generated among the participants. This sense of belonging, however, is difficult to foster in a "top-down" project. Hence there is a need for a better balance between the "top-down" and "bottom-up" influences in the development of such projects.

Keywords European information society, rural development, rural telecommunications

In response to both national and European initiatives for developing the information society, development projects are being initiated all over Europe. This article focuses on projects that seek to bring disadvantaged groups and geographic locations, especially rural areas, into the information age. It compares four projects to shed light on the practical process and difficulties of engaging people in efforts to create "European information society for us all" (European Commission, 1997).

Although the projects seem very different from each other, they have some important common features not previously recognized in the literature. First, in addition to local and national funding all of the projects receive funding from the European Union (EU). Second, in all the cases a research institute is engaged in facilitating the project. Third, all the cases are defined in terms of local development projects. In sum, the interest or perceived need to "go virtual" did not initially arise from within the groups concerned, but were responses to the opportunity provided by external sources.

The article is structured as follows: First, we briefly describe the four cases, their backgrounds and the methodologies used in the projects. The case studies are then used as vehicles for understanding practical issues and problems related to ICT development projects. This analysis is conducted in two parts. The first part identifies various actors, their roles, and the process of change. The second part discusses more specifically the problems of ICT supported interaction and the setting up of ICT supported networks. Conclusions and suggestions for further research follow.

CASE DESCRIPTIONS

Three of the four cases are situated in regions within a single country: one in Finland and two in Italy. The fourth project involves collaboration between rural towns in Belgium, the Netherlands, Norway, France, and the United Kingdom. At the outset the level of ICT skills of the participants in each project was very low.

IT Families[1]

The IT Families project was part of a larger collaborative project between national and local authorities that sought to develop local IT know-how in southeastern Finland. The mayor in the town of Loviisa took the initiative in the IT families project, a joint venture between the municipality and the Swedish School of Economics and Business Administration in Helsinki (SSEBA). It involved setting up a pilot project for developing IT skills in the community. SSEBA was responsible for the organization of the project and research based on it, whereas the municipality partly funded the project. Other funding came from the regional authorities and the EU regional development fund.

The research approach in the project was longitudinal and explorative. Both quantitative data on computer use and qualitative data on information technology and the information society at large were gathered. The aim was to understand how the information society is perceived at a grass-roots level and how ICT affect people's everyday life in general.

The project was advertised through local media. On the basis of applications and interviews, 50 young families of different types (i.e., traditional, single parent, mixed), a total of 180 people, were selected to participate in the project. The primary criteria for selection were twofold. One, the family did not own or have access to a computer at home. Two, the research team would be allowed to access any information it wanted about how and for what purpose the family used the computer during the course of the project. The participating families received a computer, a printer, an Internet connection (through a modem), an e-mail account for each family member over 6 years old, and a project home page. Training and technical support for a period of almost 2 years was also provided. The project started in April 2000 and continued until December 2001, after which the families could either buy the computer for a small fee, or return it to the research team. With this kind of concrete incentive, the overall level of commitment to participate and stay in the project could be characterized as fairly high.

This case can be summarized as an attempt to create a loosely coupled network of families with the common goal of learning IT skills and becoming part of the information society. When the project was over it was up to the families whether they continued to be part of the group or not. Interaction among participants was facilitated by a web-based platform that among other things allowed sharing of photos and drawings made by the children. Communication with the research team was ICT supported, for example, in the collection of data, as well as face-to-face, for example, during house calls, training sessions, and social events where the families were brought together.

BookTownNet[2]

A book town is a destination concept where a number of second-hand book dealers set up shops in one rural location. Since the first book town was established in Wales in 1961 (Seaton, 1996), the concept has been adopted in many towns, and currently there are 29 book towns worldwide. BookTownNet, in turn, is a project within the Fourth Framework Telematics Application Programme (TAP) of the European Commission, Directorate General XIII. It began in July 1998 and ran until September 2000. The project was a result of contacts made between people involved in the development of book towns in Belgium, the Netherlands, Norway, France and Wales. It was set up as a pan-European partnership comprising 13 SME (small and medium-sized enterprises) book dealers specializing in second-hand and antiquarian books, two municipal organizations, and two academic institutions. One of the academic institutions was a technical institute that handled project management and the development of technical tools, and the other was responsible for the evaluation of the project activities.

The five book towns participating in the project had between 300 and 1600 inhabitants and there were at that time between 12 and 36 bookshops in each town or village. The relationship between the booksellers was characterized by both a high degree of collaboration in developing the town and attracting visitors, and a high degree of competition in selling books. However, with increasing sales of books over the Internet, the book towns started facing a threat of marginalization. The project aimed at improving IT skills in the participating enterprises and the surrounding local communities. Through increased collaboration and interaction between them, the goal was to develop an international network for the enterprises in the five towns.

A number of Internet tools were developed for the project. The participants were given introductory courses in use of computers and Internet tools in general, and the ones specifically developed for the project. The project partners met six times as a large group and in a number of smaller work sessions that fostered relationships among the booksellers. As a result of the project, the five book town communities were connected together into a small international network that became stronger as other book towns joined it after the completion of the project.

In the first 2 years of the project the participants received about 40% of the funding from the European Commission. Now that the funded project is finished, the network is financed through membership fees from the participants and it is continuing to expand to new book towns. The common web site is now maintained and owned by the International Organisation of Book Towns.

Tax Team

The Laboratory of Information and Communication Technologies of the University of Trento was one of the sites in the Mediasite project within the TAP of the European Commission, Directorate General XIII. The aim of the initiative was to investigate, through development and validation work on digital sites, to what extent ICT-based integrated applications are appropriate for meeting the diversified needs of citizens, business communities, and nonprofit organizations in a user-friendly and cost-effective manner.

The number of documents circulating among the tax offices in the Alpine region in northern Italy was very high. Despite the difficulty and time it takes to travel over and around the mountains between cities, information and documents were so nonstandardized and difficult to compare that they often required face-to-face meetings between people from the different offices. The local government authorities agreed with the researchers that the local tax offices could benefit from a web-based system that promoted and speeded up information sharing between people working in different places. The idea behind the project was to increase efficiency and save costs by connecting people with networked PCs and providing them with new tools and skills to use them. It sought to transform a community of practice within the tax offices (a central office in the valley and seven satellite offices on the mountains) into an ICT-supported, virtual community of practice.

The research project focused on the processes in the development of new virtual communities and transformation of organizational cultures. The methodology for the case was action research (Lewin, 1947; Foster, 1972). The tools used for the platform were in accordance with the Mediasite applications for virtual communities, including multicast video conferencing, virtual meeting points, shared documents, and e-mail. In the first part of the project new users were taught ICT skills through classroom teaching and group work. In the second part they had several online learning sessions, followed by online technical support and guidance. The visible presence of the researchers was expected to decrease as the project progressed.

Valley Net

The Valley Net project started in June 2000, with the aim of developing cooperation between enterprises in a valley in northeastern Italy. The local government decided to promote the project, with half of the costs coming from the EU regional development fund. The remaining half was provided by the enterprises involved in the project. The Laboratory of Information and Communication Technologies of the University of Trento organized a research team on request from the government.

Two strategic enterprises, an Internet provider and a financial consultant, were first contacted to help the team select 13 heterogeneous SMEs that could be engaged in the project. The SMEs joined the project enthusiastically, seeing a chance for facilitated entry into the new economy and an opportunity for organizational change. Together with the enterprises, the research team started to develop an ICT system to support cooperation in the new network. Questionnaires were used to assess ICT skills, and two colloquium rounds with managers from participating companies were organized to discuss issues concerning technology and training. Finally, a meeting with all the participants was arranged to discuss the overall strategy of the project. The SMEs and the research team negotiated the formation of a consortium for managing both the ICT system while it was under construction and the subsequent training. After the negotiations, an "interbusiness corporate portal" was installed as a tool for communication and resource sharing between the local enterprises, and connecting the valley to the rest of the networked world.

The long-term goal of the project was to involve all of the 80 enterprises in the valley, with the help of the tools that had been developed (such as technology, skills,

relations, and models of training). Plans to undertake a similar project on a regional scale were also considered by the research team. Enterprises in the initial project were pleased to be among the first to be involved in a "big dimension project."

Some Remarks on Research Methodology

The Tax Team and Vally Net projects were carried out applying action research methods. Action research is a deeply participative research method based on the pioneering work of Kurt Lewin (1947), and it has been developed further in many research fields. It has, for example, been used in the organization tradition (Foster, 1972), and it is increasingly important in research on information systems (Baskerville, 1999). Action research is an applied research method, where researchers participate in the process of obtaining practical results at the same time as they are contributing to theoretical knowledge (Galliers, 1992).

The two other case projects, IT Families and Book-TownNet, perhaps cannot be said to be clear-cut examples of action research, but the researchers were involved as facilitators throughout the process, thus influencing their development. Observations, documents, and information were obtained as the project progressed, but they were not used to reformulate the projects during the process. They were analyzed after the project was completed. Researchers in both projects had active roles as facilitators and in that sense did not even try to stay removed as silent observers; they did of course contribute continuously to the development of the projects.

SOCIAL CONSTRUCTION OF NETWORKS AND TECHNOLOGIES

Collaborative networks, organizations as well as communities, whether ICT supported or not, are socially constructed, emergent works-in-progress; that is, communication and interaction between members create, change, and sustain them. Social organizations emerge "as their actors respond to contingencies, interact with each other and continually re-negotiate the 'rules of the game'" (Ngwenyama, 1998). Also, technology is socially constructed (Bijker et al., 1987) by the various actors and reflects back on social structures when in use (Orlikowski, 1992). In other words, developing an ICT-supported network is an iterative process that involves a coevolution of organization and technology. The process involves complex trade-offs between a wide range of heterogeneous factors, including politics, economics, professional preferences, design tools, available raw materials and resources, human behavior, and the natural environment (e.g., Bijker & Law, 1992).

The European Information Society Context

One of the vehicles that the European Commission is using to facilitate the development of the "information society" is the TAP program for research, through which two of the projects have received partial funding.[3] Another vehicle is the EU development funds, through which the other two projects have received partial funding. Thus, political forces as high up as at the EU level have played a role in how the four projects have been shaped.

In the political arena in Europe the "information society" is used quite differently from how it is theoretically discussed by, for example, Webster (2002) or Castells (1996).[4] In the European political arena it is used rhetorically as the solution to a range of complex social problems, accommodating disparate, even utopian, European ambitions (Servaes & Burgelman, 2000; Häyrinen-Alestalo, 2001) For example, the European Commission suggests that information society policies should aim at improving access to information, enhancing democracy and social justice, promoting employability and lifelong learning, strengthening the capacity of the EU economy to achieve high sustainable growth and employment, achieving and enhancing equal opportunity between men and women, promoting inclusion and supporting people with special needs and those lacking opportunities improving their position, and improving quality and efficiency of public administration (Servaes & Burgelman, 2000; see also Schienstock, 1999). In these efforts ICTs are often projected (Schienstock, 1999) as the enabling force (e.g., Agres et al., 1998). For example, with the launch of the eEurope initiative and the way information society projects are defined as ICT projects, the European information society program seems to be more about promoting ICTs (e.g., Aro, 1998) in all areas of life than about anything else.

On the flip side, however, lies the seemingly forgotten fact that there is little proof that the overarching information society aims, as, for example, stated by the European Commission, can be reached by introducing more ICT (for critical discussions see, e.g., Aro, 1998; Bjørn-Andersen, 1988; Hintikka, 1998; Häyrinen-Alestalo, 2001; Stolterman, 1995). In Finland, for example, increased technologization has untill now meant a hardening of values and increased dissatisfaction and anxiety, especially in the sphere of working life, rather than the opposite (Pyöriä, 2001; see also Tolsby, 2000, and Blom et al., 2001).

Mobilizing Knowledge Resources Through Networks

An underlying assumption of local area development efforts is that increased access to knowledge resources promotes innovation and economic growth. The most commonly cited knowledge resources include intellectual,

social, cultural, and institutional capital (Putnam, 1993; Bourdieu, 2001; Healey et al., 1999). Social capital, for example, means that social connections and other social resources can be drawn on to achieve personal or collective goals, for example, through social obligations (like indebtedness and gratitude), which in certain conditions can even be converted into economic capital (Bourdieu, 2001). Healey et al. (1999) use the term "institutional capital" to refer to a combination of knowledge resources, relational resources, and mobilization capability in a society. The availability of knowledge and relational resources can be seen as preconditions for developing sustainable institutional capability. To attain social goals, these resources need to be mobilized deliberately, for example, with the use of arenas, mobilization techniques, and change agents (Healey et al., 1999; Amdam & Veggeland, 1998). The four cases studied for this article were based on the assumption that ICT is the key to this mobilization.

Identifying Major Actors and Their Roles in the Development Process

Apart from the political forces at the EU level there were of course other influential actors involved in the shaping of these development projects. The four major actors that were identified in the four cases and their roles are outlined in Table 1. In each stage of the projects the relative importance of different actors varied. The initiator played a major role in the initiation phase, followed by the facilitators who carried out and coordinated the main construction work with the help of other actors, especially community or network members. The technology has an important role throughout the process, since it is both the main tool for supporting activities and one of the main targets of the development process. Also the members of the network have a crucial role throughout, since they are the ones who are mainly concerned with the whole effort. At the end of the project, it was hoped that the network would become self-sustained and the knowledge of ICT use would have reached a level where self-learning was possible, with minimal involvement from the initiators and facilitators.

We also used the cases to identify the actual process of a development project (see Table 2), going from motivation to initiation, to carrying out the change effort, and ending up with a transformed situation where interaction has in fact moved into an ICT-supported dimension and learning on how to make use of IT has occurred.

"VIRTUAL" ENVIRONMENTS AND ICT-SUPPORTED INTERACTION

This section analyzes the projects more specifically with regard to the problems of ICT supported interaction and issues of concern in setting up ICT-supported networks. First we present a theoretical introduction and discussion. Second, we identify and compare issues of concern within

TABLE 1
Actors in ICT development project

Actor and role	IT Families	BookTownNet	Tax Team	Valley Net
Community: the people, network, or organizations who are targeted by and participate in the effort	50 Families (F) (180 people)	5 Towns (BT), 4 organizations, 12 shops	1 Central office, 7 satellites (S)	13 SMEs (E) in manufacturing and service + research team
Initiator: providing the motivation, funding, and support for the project	Municipality/mayor in collaboration with research institute	Network of actors: one actor in each town (+ researchers)	EU project (followed by local government)	Local government + enterprises + research team
Facilitator: executing the work, providing and coordinating resources	Research institute	Researchers + BT coordinators	Researchers	2 Companies + research team
Technology: the ICT that will be used to support the activities of the people involved	PC, modem, Internet (e-mail and web facilities)	PC, Internet (e-mail and web facilities)	Web-based platform (video conferencing, virtual meeting points, shared documents, e-mail)	PC, Internet

TABLE 2
Factors in the development process

	IT Families	BookTownNet	Tax Team	Valley Net
Opportunity	EU regional development fund	Call in the EU 4th framework TAP	Call in the EU 4th framework TAP	EU regional development fund
Motivation/initiation	Develop local area knowledge, increase geographical know-how	Challenged by e-economy, and need for more collaboration	Forced participation, facilitated communication, reduce travel	Access to more resources (from local government
Transformation	Creation of a new loose community	From 5 individual communities to network of communities	From a real community of practice to a virtual community of practice	Perception of portal: from actor to platform
Network structure				
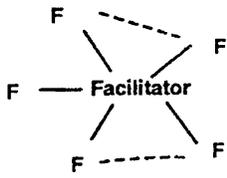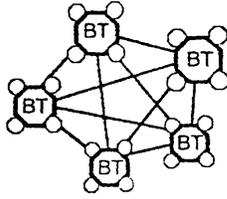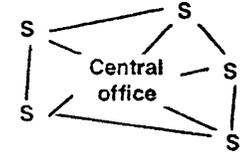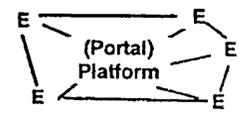
and across the four cases. In the end of the section we schematically compare the four cases to each other and to the issues presented in the theoretical discussion.

ICT-Supported Networking

ICT-supported networking is often described as "virtual" as in virtual office, virtual organization, virtual community, or virtual team. In much of the research literature "virtual" is used in an unproblematic way to encompass any time and/or place transversing interaction supported by ICT (e.g., Townsend et al., 1998). In addition to physical and temporal location, Watson-Manheim et al. (2002) identified other dimensions (e.g., in Malone & Laubacher, 1998) of "virtual": work-group membership, organizational affiliation, relationship with an organization (e.g., permanent vs. self-employed or temporary worker), and functional, organizational, regional, or national culture. From the computer-mediated communication literature the concept of presence (Lombard & Ditton, 1997) alerts us to discontinuities for people who are used to working closely together, or exchanging ideas and skills (also tacit) on a continuous basis (e.g., Turkle, 1996).

When changes are introduced into a work environment by ICT supported work, factors that have *not* changed may become more critical for overcoming the discontinuity (Watson-Manheim et al., 2002). In other words, to make sense of a changing environment, finding out what is still the same may be vital for understanding the change and how to act and relate to it. Continuities can be seen

as the partial order, or stability, that enables and supports change and flexibility. Such continuities could be factors such as shared motivation, understanding of the task, mutual expectations, shared beliefs and values, and shared practice. As in a "real" community or organization, a "virtual" one is also composed of social aggregations that emerge when people are sharing something meaningful to them. A virtual community or network is thus no different in that it has to support interaction between people over time (Rheingold, 1994). For this kind of continuity Bruckman and Resnick (1995) suggest that the combination of an ability to construct things in and change the context of the platform, that is, designing objects and spaces in and adding features to the ICT platform, is particularly powerful in constructing a sense of belonging among members.

Because "virtual" has become such a buzzword, its meaning has to some extent become blurred (Watson-Manheim et al., 2002). In an attempt to make sense of this research area, Watson-Manheim et al. (2002) recognize and distinguish among eight different virtual work environments in their review. The following represent those most closely representing the four cases discussed in this article.

Virtual supply chain: network of individual organizational units organized around a specific task (ongoing relationship).
Virtual corporation: temporary network of independent companies linked through IT.

Distributed organization: organizations consisting of two or more semiautonomous units in different geographical locations linked through IT.

Virtual enterprise networks: aggregations of small to medium-sized enterprises (as opposed to decomposition of large organizations).

Distributed individuals in field settings.

As all the four projects have the character of development projects—that is, they are not primarily driven by economic goals—they do not perfectly match these categories. The analysis could therefore also benefit from a comparison with projects developing and supporting community networking with new technologies (for such projects see, e.g., Uotinen et al., 2001; Bannon & Griffin, 2001; Ferlander & Timms, 2001).

Community networking projects date back to 1960s and 1970s (Bannon & Griffin, 2001), though in those early days they did not attain much success. According to Bannon and Griffin (2001), the reasons for failure of those early projects ranged from lack of funds, lack of technical support personnel, and internal politics around the primary uses of the network, to lack of clear objectives of the overall purpose of the network.

Bannon and Griffin (2001) maintain that although IT has become more stable and robust, interfaces more usable, Internet and standardized www browsers more accessible, and the effort to learn how to use IT has been minimized, important barriers to developing community networks have not been addressed. Such barriers, they summarize, are lack of clear objectives for the network, poor understanding of the needs of the groups that are encouraged or keen to be involved, lack of understanding of reasons for groups not wanting to communicate and share information, or little real benefits provided from partici-

pation in the network. Reasons for the existence of such barriers include lack of input from targeted community regarding their needs, and emphasis on using technology, that is, technology-push, rather than attempts to solve real problems perceived by the community. In other words, they conclude, technology should be used as a means to an end defined from within the community and not as an end in itself as often is the case.

Issues of Concern in the Projects

This part of the analysis identifies some of the main concerns in the four projects. Issues were identified within three different realms: the technical, the organizational, and the individual (receiver) realm (see Table 3).

IT Families. A general concern in the IT Families case was the increasing lack of organizational resources to follow through on the initial plan. The research team was understaffed and the financial resources were inadequate. Also, sustained support from the initiators was not forthcoming. In retrospect, overly ambitious plans at the outset might have caused the problem. Even though the initial work with the companies and the technical platform was accomplished, the original idea to also include a group of local sales companies was slow in materializing. Furthermore, the project home page for the families was still under construction halfway through the project. With regard to the technology itself, families were increasingly irritated by the slowness of the modem connections to the Internet. This not only resulted in irritation, but also in higher phone bills. Other types of concerns were related, for example, to the security of Internet shopping and payments.

TABLE 3
Summary of critical issues and concerns

	IT Families	BookTownNet	Tax Team	Valley Net
Technical	• Slow modems/bandwidth • Machines breaking down	• Working online—slowness of system	• Slow connection/bandwidth	• Heterogeneity of technical support
Organizational	• Lack of continuous support from initiators • Lack of resources in research team	• Critical mass • Lack of resources	• Organizational culture for the virtual community • Resistance to change	• Training • Role confusion in organizations • Resistance to change
Individual	• Higher phone bills • Insecurity regarding payments over Internet • Lack of ICT skills	• Lack of ICT skills • Changing expectations • Different culture and language	• Lack of ICT skills • Softly forced • Understanding g-new work environment	• Heterogeneity in skills among organizations • Lack of long-term perspective • Changing expectations → changing specifications

BookTownNet.   The multicultural aspect, particularly different languages, of the BookTownNet project was a limiting factor. English was used as the common language between the project partners belonging to four different language groups. While the Internet web site was set up to be multilingual, translation between languages was not automated but done manually offline; online communication between individuals therefore needed to be in English, though some of the booksellers were hesitant to express themselves in a foreign language. The language problem probably undermined the creation of a critical mass of users on the Intranet part of the project. The bookshop partners in the project were very small enterprises, having one or two employees. Consequently the time for getting acquainted with the computer system was very limited. Tending to the network was low priority for the smallest enterprises, especially during peak seasons when customer service required great attention. Also, the needs of the booksellers expressed at the beginning of the project quickly changed as they became acquainted with the Internet. All these changes in expectations could not be accommodated. On another level, the greater than anticipated time spent on technical issues reduced the available meeting time for other matters.

Tax Team.   In the Tax Team case the participants also experienced a number of technical difficulties, largely because of low level of IT skills and problems related to slow Internet connections. Some participants also resisted change, as they did not see why the old way, which worked perfectly well from their point of view, needed to be changed for something incredibly complicated. There was also discomfort with the way of working in a virtual environment. The tax office clerks were used to talking about their personal lives during job related meetings, and about work during coffee breaks. This dynamic way of communicating was difficult to replicate in electronically mediated interaction. The clerks therefore felt too controlled and stressed by the technology. Even though the participants agreed in principle with the benefits provided by a "virtual office" (i.e., less time to move information, personalization of working place, better knowledge management, saving costs, and better information flow) they did not volunteer on their own to participate in the project, but where coerced to do so by the local authorities and researchers.

Valley Net.   Forging a consensus among the participants in the Valley Net case was not easy. The main problem was creation of a common understanding of the technology, rather than the final outcome of the project. Since there were no prior relationships among the enterprises participating in the project, relationships had to be established in order to facilitate the growth of the network. The problem was that some of the enterprises had neither Internet connections nor ICT skills and no intentions whatsoever of investing resources and time in acquiring them. As the project needed a commonly agreed minimum level of technology to continue, the research team was forced to start a training program on ICT use and its implications for organizational innovation. The project also suffered from the classic problems of many action research projects: It was difficult to develop a change process cooperatively when some actors expected to gain benefits but were not receptive to external involvement or consultancy.

Relational Problems Across Cases

From the perspective of the actors and their roles (as was described earlier), the critical concerns in each case seemed to arise from their relationships to each other and the problems of managing different expectations between them (see Table 4). For example, the initiators' plans may have been more ambitious than what the facilitators, in collaboration with the network concerned, were able to carry out. There might also have been a mismatch between the expected (by the initiator) and the actual amount of effort needed (by the members) to succeed in building and sustaining an ICT supported network. Existing technical skills and capabilities of members in the development efforts varied from extensive to none. Even if the difficulties in finding different kinds of resources and issues and training are been taken into consideration in the design of a project, they can still surface as differences in expectations as the project unfolds.

While the mismatch in expectations also occurred in the facilitator–community link, in the Valley Net case the research team was able to capitalize on this disparity in a positive way. The facilitators worked with the companies to create the relations needed for additional work. At

TABLE 4
Issues related to the relations between actors in an information society development project

Relation	Issues identified in the four cases
Initiator–facilitator	Expectations about project outcomes
Facilitator–community	Expectations about IT skills knowledge and development
Initiator–community	Expectations about initial ICT skills and project motivation
Technology–community	ICT skills; expectations about technology
Facilitator–technology	Expectations and knowledge about technology
Initiator–technology	Expectations and knowledge about technology

TABLE 5
Types of network characteristics, discontinuities, continuities, and problem areas in the cases

	IT Families	Valley Net	Tax Team	BookTownNet
Applicable types of network characteristics				
Virtual supply chain[a]				X
Virtual corporation[a]		X		
Distributed organization[a]			X	
Virtual enterprise[a]				X
Distributed individuals[a]	X			
Identified discontinuities				
Physical location[a]	X	X	X	X
Temporal location[a]				X
Functional culture[a]	X	X		X
Regional culture[a]			(X)	X
National culture[a]				X
Presence important[a]			X	
Geographical location[a,b]			X	X
Organizational culture[a,c]		X	X	X
Language[a,d]	X			X
Identified continuities				
Shared motivation[a]	X	?		(X)
Understanding of task[a]		X		
Mutual expectations[a]			X	
Shared beliefs and values[a]	X			
Shared media[a]		X	X	X
Shared practice[a]			X	X
Option to construct and change things in ICT platform[a] (contribute to network)	Minimal	?	?	?
Shared goal[a,e]	X	X?	X?	(X)
Incentive/sanction[a,f]	X		X	X
Identified problem areas				
Lack of funds[a]	X			
Lack of technical support personnel[a]	X			X?
Politics around primary use of network[a]		X?		
Lack of clear objectives of purpose[a]		X initially	X initially	X initially
Poor understanding of local needs[a]				
Lack of understanding of groups not wanting to share information[a]		X initially		X initially
Little real benefits from participation (as perceived by target group)[a]		X?	X	
Technology-push/Lack of local problem-solving focus[a]	X	X	X	X?
Technology-related problems[a,g]	X		X	X
Problems with ICT skills/learning[a,h]	X	X	X	X
Insecurity regarding how to act in ICT supported environment[h]	X	X	X	X

[a] Identified in literature.
[b] Identified in cases as separate from physical location.
[c] Identified in cases as separate from organizational regional culture.
[d] Identified in cases as separate from culture.
[e] Identified in cases as separate from motivation.
[f] Identified in cases.
[g] Identified in cases as still existing and varying highly.
[h] Identified in cases as most time-consuming problem.

the same time the researchers "played" with the expectations of the enterprises, getting them to compete with each other. In an attempt to get to the cutting edge, the companies focused on core innovations and concepts such as e-commerce, net economy, and training support. The facilitators were able to establish real collaboration between enterprises that previously did not communicate at all.

In sum, the projects can be seen as complicated webs of expectations between major actors, as schematically expressed in Table 4. This framework alerts one to the potential problems in the development of a ICT project.

Creating and Maintaining Action in ICT-Supported Networks

It seems to take a lot of time and practice to get acclimatized to working in an ICT-supported environment. Initiating collaboration in an ICT-supported environment raises problems like trusting people one has never met, finding a common language to communicate, understanding the technology, and in some cases overcoming the lack of a shared culture to increase mutual understanding between people. Overcoming these kinds of obstacles takes a lot of individual effort and willingness to learn from the participants. The members of a network need both time and persuasion from facilitators to adjust to the new environment, which is also the one reason that the development process takes a couple of years to bear fruit. If the initiators and facilitators do not recognize the need to establish common ground among the network participants, the project is quite likely to fail. Only if the participants find real benefits in using the new space can they grow to appreciate it and learn more about using ICT.

A critical mass of users in the virtual space seems to be crucial for getting a network to work. However, what constitutes this "critical mass" varied case by case, depending on the nature and the purpose of the network. In the BookTownNet project there was little or no previous collaboration between the participants, so a sufficient number of members were needed from the start to get the collaboration going. In the Tax Team project, on the other hand, the problem of creating critical mass was solved by forced participation. In the Valley Net case the challenge was to get the enterprises to use the portal. Since it was a technological tool under construction, it needed to be used in order to be developed. While monitoring the use of the tool, it was realized that only the research team was actively using it. In order to create and maintain a critical mass of users, strategies to "force" the enterprises to use the system were sought. In the IT Families case, which did not involve the creation of a communication network, the success of the project depended on the extent to which the project web page was used. If nothing happened there for a length of time, people were not very likely to come back

without an external signal, for example, in the form of an e-mail from the facilitator.

If the network is to be self-sufficient without future involvement from initiators or facilitators, it is important that the facilitators recognize the need for various types of critical mass and find means to create and maintain it. One of the important tasks for the facilitators and also the initiators, who are from outside the community, is to prepare the time for when they have to extract themselves from the projects. It is important that they leave behind, among the participants, the enthusiasm that they brought to it.

Table 5 summarizes the four cases. It schematically compares the four projects with the types of network characteristics, discontinuities, continuities, and possible problem areas that were identified in the literature. Discontinuities that were not identified in the literature, but could be identified in the cases, such as geographical location, language, and organizational culture, have been added. Shared goals was identified as an additional continuity, but at the same time various forms of incentives were used. Further, lack of resources in terms of time and money also played a role in the development of the networks or communities.

CONCLUSIONS

In this article we have explored a type of local development project that is emerging Europe-wide. These projects emerge not only from an internal need perceived by the group concerned, but also as a response to the opportunity opened up by political initiatives, both at European and national levels. The people and organizations involved in the cases did not typically have much prior interaction, but were often "forced" to first develop relations among themselves, which formed the foundation of ICT enabled networks.

The process of constructing these networks included at least four important factors, the initiators (both at a political and local level), the facilitators, ICT, and the community that the project was aimed at. Constructing an ICT-supported network is, like any community, a truly sociotechnical process where issues emerge and have to be addressed as the situation unfolds and where both technological application and social structures are coevolving and changing as the construction continues. Making expectations explicit between actors on a continuous basis should therefore gain priority at all levels in the process.

Although the implementation of the technology has been quite straightforward, the sense making and negotiation between actors in the projects took much more time and effort than initially expected. This suggests that the discrepancy between actors' expectations was quite large. The political process also influenced the construction process as the actors directly involved in the process were

not always allowed to freely develop the project as they thought fit. Since politics greatly influence how a network is developed, we suggest that this is one area where more research is needed at both the national and European level. It is also important for the political bodies initiating these kinds of initiatives to be aware of their role. Also interests behind the actors are not always clear-cut, nor serving solely the best interests of the people who are targets of the projects. One question for research would thus be to consider how well the combination of bottom-up and more top-down construction approaches works and how to balance between the degrees of structure imposed from the political system and the freedom of choice in the involved communities. It further gives reason to consider how bottom-up approaches could gain more support in the initiation of local development projects, that is, when frameworks and objectives are already set at the EU level as a product of top level politics.

One factor that all four cases seem to have to some extent neglected or paid less attention to than needed was the establishment of a critical mass of users, without which an ICT-supported network is at risk of dying out. The problem of creating critical mass may also be a result of the mismatch between bottom-up and top-down approaches, which makes it all the more important to further conduct research into the interests behind the actors and the relationships between different approaches.

NOTES

1. For more in-depth work on the IT Families case see Gripenberg (2002).

2. For more in-depth work on the BookTownNet case see Skogseid and Jansen (2001) and Jansen and Skogseid (2002).

3. See, e.g., CORDIS at http:/www.cordis.lu/en/src/f_001_en.htm

4. In theory it is still debatable whether the information society is a fundamentally different form of society or it is a continuation of previous forms (Webster, 2002) and whether or not it is coming, existing, or already passed (e.g., Knuuttila, 2001).

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Appendix D

Ingjerd Skogseid *&* Geir L. Strand

Bottom-up Initiatives' Role in Technological Regional Development

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Ingjerd Skogseid and Geir Liavåg Strand

BOTTOM-UP INITIATIVES' ROLE IN TECHNOLOGICAL REGIONAL DEVELOPMENT

Abstract

The liberalisation of the telecommunication market has become a challenge for many remote areas. Some areas have been able to meet the challenge and some have not and are suffering from poor access to infrastructure. We will present two actual cases of local infrastructure building. We will further present a framework based on theories from different strands; Regional Planning; Regional Economics and Innovation Systems; and Information Systems Infrastructure, Diffusion and Adoption. The two cases will be discussed in relation to the framework. The cases are two examples of bottom-up initiatives which play an important role in regional development. A major finding in both of these cases has been that working together will provide the customer with better services. In every bottom-up initiative there will be a different set of challenges dependent on the local context.

Introduction

The current situation for regional development reflects the duality of globalisation and marginalisation. Some countries, regions, towns and enterprises are not able or allowed to follow the general development. The continuously increasing speed of diffusion and use of

information and communication technology (ICT) is an important reason for this situation and is one of the major elements of the new external conditions that national and regional economics are facing.

The use of ICT is changing the way society is organised. It can furthermore be claimed that the quality and capacity of innovation systems such as the production structure and supporting organisations will have a decisive influence on how we are able to cope with these challenges. How can regions or enterprises threatened with being marginalised cope with the challenge? While development is mainly driven by large multinational organisations which have the resources required for such a development, are small enterprises able adapt to this and build networks which allow them to participate in the development on their own terms without being bought up by larger organisations or being marginalised? Market liberalisation in the telecom sector has made the situation more difficult for remote areas.

The following cases report the development of local broadband initiatives, and aim at explaining the key factors which have contributed to their rather successful development. Our specific aim is to examine the communities which have met the external challenges and used institutional capital to build up a regional infrastructure and support system to ensure that they are connected to the national and global infrastructure.

Theoretical Background

The focus is on the diffusion and adoption of ICT systems in organisations, in particular in a regional and local context. This research approach requires that we combine theories from the fields of regional economics, innovation / diffusion theory, and information systems (IS)

research. While the IS literature can help us understand how organisations are implementing and adapting ICT systems, theories from regional economics and innovation and diffusion theory may contribute toward clarifying what characteristics of regional economies are most important in explaining different diffusion patterns.

The linear innovation and diffusion model, which for a long time was dominating, is now widely accepted as being too simple to explain all situations (see Lundvall 1992; Malecki 1991; Rogers 2001). Various research work has pointed out that such processes are influenced by a number of factors, both at a micro and more aggregate levels. The term *regional innovation systems* has thus been introduced to explain part of this complexity. The main characteristics of regional innovation systems, as defined through evolutionary research in the fields of regional economics (Morgan 1997), are 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 & Isaksen 1997; Dietrichs & Smith 1997; Lundvall 1992). 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 & Johnsen 1997).

Local communities are currently facing challenges both from within and other parts of the world. 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; Bennett & McCoshan 1993; 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).

Healey et al. (1999) offers a framework that describes how the interaction between external

pressure and local institutional capacities, knowledge and relational resources, and

mobilisation capability can lead to collective action and hence innovation.
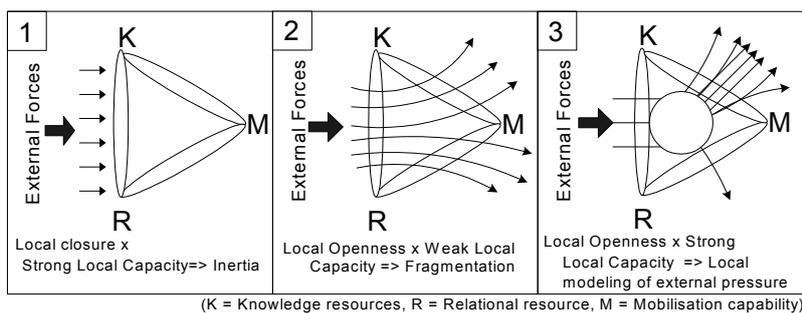
(K = Knowledge resources, R = Relational resource, M = Mobilisation capability)

Figure 1 Three alternative scenarios describing how external challenges or forces are

managed in a community and how the institutional capital influences the outcome of the

modelling process. Modified from Healey & al. 1999.

Healey et al. (1999) examines the factors that may enable a region to break from the past path

dependent trajectory. They suggest that when communities are facing new external

challenges, then three alternative scenarios can be described. Institutional capital can be

developed to enable regions to allow local initiatives to be "shaped by powerful external

forces, [which] can mobilise and transform inherited traditions and practices and thereby

shape the futures of localities in ways which enhance quality of life, the business environment and environmental quality in socially-just and inclusive ways" (Healey et al. 1999, 123). The communities can reject the challenge but with the risk of *inertia* (Figure 1.1), or the technology prone communities can start to use it with the risk of *fragmentation* (Figure 1.2) or can mobilise their initiative to *model the external pressure* to suit their own needs (Figure 1.3). To be able to make a change in the path dependent trajectory the three components, knowledge, relational resources and mobilisation capability, need to be strengthened.

Technology has only recently been considered to be a distinct factor in regional economics, such as in Storper (1997), which explains an innovation system as a multi-layered structure including technologies, organisations, and territories. In this structure, technological changes are recognised as one of the principal drivers in changing territorial patterns of economic development in the social context, which is also being emphasised by other researchers (Asheim & Isaksen 1997; Dietrichs & Smith 1997; Lundvall 1992). Organisations are not only dependent on territorial contexts of physical and intangible inputs, but they have greater or lesser proximity to each other. Innovative activity is seen as partly a local and regional phenomenon that represents a new theoretical understanding of how the innovation process occurs, is concretised in the interactive innovation model (Asheim & Isaksen 1997; Isaksen 2000). This model defines innovations as interactive, non-linear knowledge development and transfer: technology and knowledge flow freely between research and development activities, the industry and other stakeholders.

While regional economics literature traditionally viewed technology as a generic factor, our focus is to study how the specific characteristics of distinct technical systems and infrastructures influences the implementation, adoption and adaptation of ICT-based systems

(IS) in organisations. Our point of departure is that the outcome of IS implementations is dependent upon both characteristics of the technical solutions, as well as the system development processes and various organisational and contextual factors (see e.g. Damsgaard & al. 1994; Kraemer et al. 1989; Larsen and MacGuire 1998; Lyytinen and Damsgaard 1998). There are a number of studies on IS diffusion in small organisations, which emphasise the characteristics of the software (e.g. Cooper & Zmud 1990; Gross & Ginzberg 1984; Kwon & Zmud 1987; Lees 1987), as well as the quality of the infrastructure and support systems (e.g Heikkilä & al. 1991; Janson & Subramanian 1996). This seems particularly important for IS diffusion in small, rural enterprises that are lacking necessary competence and resources (Igbaria & al. 1997; Jansen 1998a).

Traditionally, developing and using ICT infrastructures has been regarded as a predominantly technical endeavour; there is now an expanding body of literature on addressing issues of social, economical and institutional nature. Recent research results emphasise the importance of understanding the infrastructures as 'multi-layered' systems including technical, organisational and human components, and their ability to support various types of inter-organisational structures, e.g. both horizontal and vertical networks (Ciborra & Hanseth 1998; Monteiro & Hanseth 1995; Rolland & Monteiro 2002).

Research Framework

To summarise the discussions above, we see IS diffusions into organisations as innovations that are dependent on the technical solutions itself, the organisational characteristics and the environment, i.e. the existing innovation system along with the technological infrastructure[1].

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[1] The distinction between the regional innovation system and the ICT infrastructure may not be clear, as we define the infrastructure as including the parts of the innovation system that support the IS acquisition, adoption and adaptation processes.

In our particular perspective, we emphasise the quality of the technical and organisational infrastructure that may support the implementation, adaptation and use of such an information system in the individual user organisations. Based on these assumptions we have developed a research framework that has been applied in the analysis of several empirical cases (Grøtte & al. 2000; Jansen 1998b; Skogseid & Jansen 2001). Our framework distinguishes between i) the external environment, ii) the regional innovation system[2] and iii) the individual organisations where innovations take place. Furthermore, we include characteristics of the current technologies that are being diffused and used by regional organisations. Below is a short description of the different components:

- *The regional innovation system*; which we assume to have different components, including:
  - o *The regional / local ICT infrastructure*; the physical data and telecommunication network, and the organisational resources that support the operation and use of the technical elements. The regional infrastructure is partly integrated into the national infrastructure, but may also include additional regionally located facilities and services.
  - o *Institutional capital;* the general ability to handle innovation and change, including knowledge, relational and mobilisation resources, entrepreneurship, norm's and attitudes in the region, etc.
- *Organisations*; where the information systems are being diffused and used, and which are supported by the infrastructure. These may be public or private organisations, described by internal characteristics and their inter-organisational relations. The main focus is on factors that we assume to be relevant to managing the technology, such as previous ICT

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[2] A region is defined here as a distinct area, such as a village, town or community.

experience and competence. The organisations may be linked together in organisational networks, in which ideas, information, knowledge, norms, etc. are exchanged and by which innovative activities are stimulated.

Outside the region or local community we assume that there is an external environment which influences a regional innovation system through two important processes:

- *Economic and social change forces;* the external pressure that causes changes in local industries and related economic matters, including market relations.

- *Technical development and diffusion;* the development of distinct ICT systems and solutions, and the diffusion of such systems into regional or local organisations. These systems will be characterised by their functionality, technical qualities, usability etc. related to the specific user domain.

These distinctions permit us to organise our work around a framework with an overall structure that can be illustrated as follows:
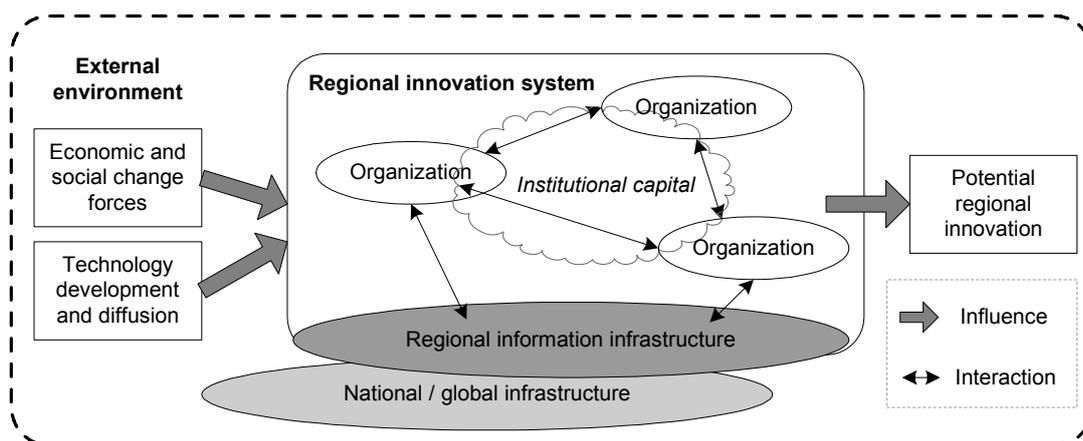
Figure 2 Research framework

The intention behind this framework is to illustrate how external forces cause the diffusion of new technology into a local community, which may eventually result in a local innovation.

Research Method

This work is based on a qualitative methodological approach. Empirical data, mostly qualitative, have been collected from documents and project reports along with observations collected through visits to the organisations involved and unstructured interviews. The research study is based on an analysis of two local broadband initiatives. This approach is situated within the interpretative strand of information systems research (Walsham 1995), aiming at making an in depth analysis of the case history.

Research Issues

The general framework depicted above is rather open. Our specific aim is to examine the communities that have met the external challenges and used the institutional capital to build up a local infrastructure and support system to ensure that they are connected to the regional, national and global infrastructure. The two cases examined have a different context and different actors. We will explore the different actors and the role they have in the bottom-up initiative. How should remote communities act in order to get access to broadband infrastructure at a reasonable cost? The motivation or driving force of the bottom-up initiative is different, but the challenges in the process are the same.

Case Description and Discussion

The liberalisation of the telecoms market in Norway caused some difficulties, in that broadband access and new infrastructure were no longer equally available at the same price all over the country. Urban areas receive new services and more high-speed access at a lower price. Rural areas may end up without all the new services, and the services which are made available are more expensive than similar services in urban areas. This is negative for rural areas. The new laws also opened up competition in the telecoms area. This gives more opportunities for rural areas, but these areas must do 'the work' themselves.

More than 10 different local bottom-up broadband initiatives are known in our region. We have selected two of these to illustrate the differences and similarities between these initiatives. The two cases represent the first initiatives and have been operating for three to five years. In the following section we will first give a description of the cases and then discuss them with regard to the theoretical contributions.

Kapasitetslaget – Sogndal Municipality

Context

Sogndal is the centre of the Sogn Region in Western Norway. The municipality has about 6,600 residents, and an additional 2,000 students during the school term. 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 og Fjordane College and the Western Norway Research Institute (Sogndal kommune 2002).

Kapasitetslaget[3]

Sogn og 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 took place in 1998, the infrastructure was purchased by the college and the municipality.

In 2000, several large public organisations and small technology companies in the Sogndal area had a need for broadband lines at inexpensive rates. As a result, 12 private companies, the local energy company "Sognekraft", the college and research institute, and regional public sector organisations[4] joined efforts and established a joint broadband company, Kapasitetslaget i Sogn AS (KL). The new company's main purpose was to negotiate inexpensive internet access and to stimulate the building of regional and local broadband infrastructure.

The broadband network was extended to two neighbouring municipalities Leikanger and Luster tn 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. During summer 2003 a new piece of infrastructure will be installed to connect Kaupanger, and it will be owned by

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[3] All quantifiable numbers are as of November 2002.

[4] The Sogn og Fjordane County Municipality and the Sogn og Fjordane Gounty Governors office.

one 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 companies have

been able to locate in the area due to the network capacity, examples of these are Asplan Viak

Internet and ArtsPages. In addition, the organisations connected to KL have been able to

participate in several international research projects such as the EU-funded projects Titan[5]

and Odin Mobile[6].

Kapasitetslaget i Sogn AS has access to national infrastructure through a 10 MBs connection

through the national provider Telenor. From February of 2003 the contract for the access was

made with TeleDanmark and the bandwidth was extended to 34 MBs, with new contracts

negotiated annually. Working jointly in negotiations has led to cheaper and faster access for

all the companies connected through KL. The business model of KL is to provide internet

access, at the lowest possible cost to its customers. Billing is estimated from consumption and

future traffic measuring will give a better division of the cost. KL gives all participants full

access to the whole bandwidth and this is the key to providing the best broadband lines at the

most inexpensive rates.

Kapasitetslaget in a Regional Innovation System Perspective

In the development of KL and the services they offer (broadband access to the Internet) the

involvement of actors from private companies, the public sector, and third level institutions

and research, the triple helix, have been essential. Across the organisations taking the

initiative was access to the knowledge and skills needed to plan and establish access to the

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[5] TITAN (Tactical Integration of Telematics Applications across Intelligent Network) was a part of the EU 4th framework programme Integrated Applications Digital Site 1998 – 2000.

[6] ODIN Geographic Distributed Information Tools and Services for the Mobile Information Society is a part of the EU 5th framework programme 2000 – 2002.

infrastructure needed. Since the owners of the existing infrastructure were also heavily involved, renting capacity from the existing infrastructure was not a problem. The combination of organisations involved has therefore been ideal.

That KL has been able to rent and make use of existing fibre infrastructure which has been an important foundation for success. In Sogndal the existing network owned by the municipality and the college was the basis for the development. The infrastructure that has made it possible to connect Leikanger and Luster to KL has been built by other actors (the two local energy companies) and Kapasitetslaget are renting these lines to be able 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.

The region originally covered by KL has traditionally had a large public sector, but this has been changing in recent years. The rhetoric from national government has been that services should be made more efficient and centralised, but should not automatically create jobs in the capital, and if possible these services should be located in more rural areas. One important part of this process has been the idea that service should still be accessible from elsewhere and the increased use of ICT access for sufficient communication capacity this has been an important factor in the localisation debate.

KL provides the backbone fibre infrastructure but is not providing any other services. The organisations that want to connect to the infrastructure have had the opportunity to do so by using a radio link (in Sogndal) or by connecting to the backbone fibre at their own cost. KL

has cultivated their business idea of selling broadband internet access. Provision of other services has been opened up for the users of the infrastructure. This method of cultivating the idea has made it possible to operate the organisation with a minimum of organisational resources. The company does not have any employees, but are renting the competence along with the infrastructure. In addition, the organisations owning the company have provided a pool of resources and skills that can be drawn upon in the operation of the infrastructure.

The initiators of KL had a common problem; they needed high capacity access to the internet to provide services at a national or international level. These services were generating heavy traffic in the form of the transfer of large files (ArtPages) or in the form of the number of requests, e.g. Norge.no, which has approximately 30,000 hits on its website every day. After KL had been established, the customer base was extended and the geographical areas covered were expanded.

Firdanett – Gloppen Municipality

Context

Gloppen is a municipality in Western Norway, with 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. Farming is still an important industry (Sandal 2002, Statistisk Sentralbyrå 2002), but currently it is the public sector that employs the most people. The textile industry has been closed down. 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.

Firdanett[7]

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.

Datainstituttet continued to expand the network but ran short of funding. To be able to better

handle the investments a new company, 'Gloppen IT nett' was established. 'Gloppen IT nett'

is 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. The

operation of the Gloppen IT nett was handled by Datainstituttet. After a year, the owners

could not agree on a joint financial and strategic plan for the company. Datainstituttet sold

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[7] All quantifiable numbers are as of November 2002

their shares to the local energy company. Gloppen IT nett was refinanced and its name was changed to Firdanett, and its is now fully owned by the local energy company. Firdanett offers broadband internet access and IP telephony, and Datainstituttet offers their ICT services to the businesses connected to the network.

Firdanett has two employees, one technician and one salesman. 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, despite the absence of the national provider Telenor, who are not offering 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). The local secondary school now offers new studies in ICT and media. Other spin-off activities are the Sandane Business Garden, which are offering an innovative environment for knowledge based firms and incubator facilities for start-ups. The establishment of a call centre (Easy Connect) with 40 new jobs, 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.

Firdanett in a Regional Innovation System Perspective

The recent history of Gloppen is one of decline with outword migration and loss of jobs. Prior to the establishment of the broadband network, key actors in the community had 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 were improving.

Companies invested in more and more computers throughout the 1990s. As the number of computers increased, a need for more security services such as backup, firewalls, anti-virus software grew. Small companies did not want to invest in these types of services themselves, but to buy them from the local service provider more cheaply.

To be able to meet these demands broadband capacity is needed, not only local, but also with access to the global Internet. Datainstituttet started the building of the infrastructure to be able to offer these services to their customers. The liberalisation of the telecom market opened up these new opportunities. No broadband infrastructure was available in Gloppen, so the entire infrastructure had to be established from scratch. This was expensive and there was no short-term payback from the investment. This caused financial problems for the owners. The organisational resources were limited, and the focus was on technology, more than on economy.

Even having had difficulties in the past, Firdanett is now offering competitive broadband internet access and IP telephony to companies and households in Gloppen. The number of customers is increasing. The national provider Telenor have no known plans to offer ADSL in Gloppen, which gives Firdanett a good potential for growth.

Conclusion

This article presents two cases of local bottom-up broadband initiatives in Western Norway. The two cases are have different types of actors involved, and differing motivation behind their initiative. If we look at these two cases with Healey's three scenarios (inertia, fragmentation and local modelling) in mind we see that a) if no initiative had been taken the risk of inertia is present, b) the fragmentation scenario would have been the case if each organisation individually had arranged their own broadband connection, and the costs would have been much higher for access to an equivalent bandwidth, and c) by working together and establishing this as a joint effort they can be said to have modelled the external conditions of their own situation and have created a win-win situation for all with less money spent on building and maintaining infrastructure and more available for the development of new opportunities in the area.

In the case of Kapasitetslaget, the triple helix situation played a major role in the establishment of the broadband network. Their main aim was to get better and less expensive broadband access for themselves and for the rest of the community. They joined forces with the companies in the community to gain their common aim.

In the case of Firdanett the process was harder. The network was established by a local ICT firm that wanted to sell ICT services to other companies in the network. To be able to finance the building of the broadband network (infrastructure) they had to seek collaboration with other actors. In difficult times it became obvious that there was not a common understanding of the purpose of the new broadband firm, and the initiator was forced to sell its shares because of a conflict of interest. The combination of infrastructure building and service provision from the initiators became too complicated and in this way the model illustrated by Kapasitetslaget has worked much better and contained no conflicts of interest. The aim of the

organisation, infrastructure building and inexpensive access to the Internet, is easy to understand and agree upon. The opportunity for all customers to develop and sell services on the net has also created new business opportunities. A major finding in these two cases has been that working together will provide the customer with high quality access to the internet at a reasonable cost.

The cases show that it pays to make an effort, and it is possible to establish a collaboration. Each case will have a different set of challenges dependent on the opportunities and benefits that can be utilised in the infrastructure building process.

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Ingjerd Skogseid *&* Ole Hanseth

Local Actors Build Broadband Infrastructure.

LOCAL ACTORS BUILD BROADBAND INFRASTRUCTURE

Ingjerd Skogseid, Western Norway Research Institute, Postboks 163, 6851 Sogndal, Norway,
Ingjerd.Skogseid@vestforsk.no

Ole Hanseth, Department of informatics, University of Oslo, Norway,
Ole.Hanseth@ifi.uio.no

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 open 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 does not apply. Two initiatives will be used to illustrate how the communities have assembled rural broadband assess using available knowledge and relational resources and infrastructure to achieve the goal, which is contrary to the traditional roll out of telecom infrastructure.

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 tele-liberalisation 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 sited 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 form 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 form 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 (Grubesic 2003, Grubesic 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
Enivest 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
Kapasitets-laget 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 KAPASITETSLAGET[2] – 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 organisations[3] applied for public funding through a national program (HØYKOM[4]) 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

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[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   FIRDANETT[5] – 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

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[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 Enivest. Enivest 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 then 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
1st 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 then 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 in 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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Appendix F

Ingjerd Skogseid

Improving Broadband Access in Rural Areas

IMPROVING BROADBAND ACCESS IN RURAL AREAS

Ingjerd Skogseid

Vestlandsforsking (Western Norway Research Institute)
Post-box 163
6851 SOGNDAL
Norway

Phone: +47 916 96 016
Fax: +47 57 67 61 90
Email: ingjerd.skogseid@vestforsk.no

IMPROVING BROADBAND ACCESS IN RURAL AREAS

ABSTRACT
The paper explores the characteristics of rural broadband infrastructure development. Taking the existing installed base into consideration, small rural communities can initiate bottom-up cultivation of broadband infrastructure. Such initiatives are important contributions to overcoming the disparity in broadband access. In effect they aggregate demand by creating a larger total market for suppliers than the individual needs of the actors. The proposal is to use descriptive clusters as a way to reveal the installed base. A set of questions and answers will be defined to reveal the installed base. This can be used to acquire an overview of the types of resources available, and the choices that need to be made. The use of descriptive clusters places emphasis on the local context and culture. With a bottom-up strategy, questions must be answered in relation to the local context. The responses and lessons learned may vary from one location to the next, making blueprint implementations impossible.

INTRODUCTION
To the question "Is it possible to improve broadband access in rural areas?" we must reply, "Yes". However, the question of "How?" must be answered by taking into consideration a combination of policies, strategies, collaboration and costs involved, not only on a national level but also on the local level. This paper explores the development of broadband access in a deregulated market and in relation to areas that are least favoured.

In countries with a deregulated telecommunications market, the process of developing the broadband infrastructure differs from earlier infrastructure processes. In a competitive market, telecommunications operators are likely to develop broadband infrastructure in urban areas, while rural areas with lower demand are developed at a much slower rate because of higher costs and insufficient demand. Access and adoption/demand of broadband technology is a 'chicken or egg' problem. Before a broadband infrastructure may be adopted, it must be made available, while the access providers require a sufficient level of demand before extending their services. However, an OECD (2004) status report on broadband provision in rural and remote areas suggests that the competitive market works even in these areas. Why is this true, and what are the characteristics of rural broadband development? This paper explores the role of the installed base in the development of two rural broadband initiatives in Sogn og Fjordane County, Norway, and discusses how different installed bases resulted in different processes and different infrastructures (see Table 3 for more details).

The paper is divided into six sections: background, research methodology, key theoretical perspectives, a description of the cases, a discussion and a conclusion, including practical implications. It explores the development of access to broadband in a rural region[1] in the context of a deregulated market. It also explores factors that influence a bottom-up development of broadband infrastructure in rural areas as opposed to the traditional rollout of infrastructure.

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[1] I use "rural areas" to describe areas that are sparsely populated, where the inhabitants live in small towns, villages, farms or isolated houses. This is used in contrast to "urban areas", which I use to describe areas such as densely populated towns and cities. However, there is a fluid boundary between the two, and some who reside in small towns or villages may regard these as urban areas, though the district on the whole may have rural characteristics.

BACKGROUND
At the time the telecommunications market was deregulated, the Norwegian government chose a demand-driven strategy for the development and delivery of broadband Internet access. The competition amongst telecommunications providers was thought to be sufficient to ensure general access to broadband services. In the context of market-driven development, it is not profitable to roll-out broadband to all parts of the country, and the national providers did not plan to develop a universal service. In March 2004, roughly 77% of Norwegian households had access to broadband infrastructure (Teleplan, 2003a), while by the end of 2005 this figure had increased to 88% (Post_og_teletilsynet, 2006a).

The government have initiated a programme called Høykom[2] to increase the demand for broadband services, which also applies to rural areas; this programme supports local and regional government by partially funding the acquisition of broadband access and the development of broadband services in the public sector. Although this support is welcomed, local and regional governments are still required to provide a substantial part of the investment required, which can sometimes prove difficult. When information and service providers deliver services requiring broadband capacity, the inhabitants and businesses must have access to a high-speed connection in order to take advantage of such services.

As a result of this situation, a myriad of broadband providers have come into existance. A study completed in 2004 identified 130 broadband providers in Norway (Norsk_Telecom, 2004), and in 2006, a similar study identified 150 providers (Post_og_teletilsynet, 2006b). In 2004, about 10 of the 130 were categorized as national providers, delivering broadband services with national coverage. About 40 were defined as "regional actors", and the remaining 80 were characterised as local providers serving local communities. The many small local providers were the result of local initiatives. The municipalities participated as owners for about 50 of the providers identified in 2004 (Norsk_Telecom, 2004).

Broadband access
Under the regulated market, new segments of the telecommunications infrastructure were often developed as a top-down rollout and were designed for specific purposes. These infrastructure segments were more or less uniform, and existed in markets which might be characterized as monopolies or duopolies (OECD, 2004). In Europe, this changed with the deregulation of the telecommunications market in 1998. As a result, the telecommunications infrastructure is now being developed in the context of a competitive market. One drawback of this development is that areas with smaller competitive markets, such as rural and remote areas, may not gain access to broadband infrastructure (Grubesic & Murray, 2002; OECD, 2004; Stanton, 2004). The constantly increasing use of information and communications technology (ICT) and the economic transformation currently underway (Grubesic, 2003), make access to broadband technology essential for people's lives.

In a competitive market, the basic assumption is that telecommunications operators are less likely to develop broadband infrastructures in rural areas because of higher costs and insufficient demand (OECD, 2004), even when they are based on an existing infrastructure,

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[2] The Norwegian Høykom (www.hoykom.no) programme is at present in its third period of operation. The programme was initiated in 1999 for a period of three years (1999 - 2001). Its current period of operation lasts from 2005 - 2007. Høykom has provided financial support for more than 400 projects on a shared-financing basis. Høykom sustains projects initiated by the public sector with up to 50 percent of total project costs, totalling more than 45 million Euros, which has led to a total project volume of more than 130 million Euros.

such as telephone lines. This is supported by a study carried out in the US, which examines the factors influencing the adoption of broadband. According to Stanton (2004, p. 9), the 'demographics for broadband access do not replicate the demographics found for computer ownership and home Internet access.' While racial and socio-economic variables influence computer ownership and Internet access, they are less important for the purchase of broadband access. Broadband access is more strongly influenced by geographical variables (Stanton, 2004) and the broadband disparity arises between urban and rural areas.

A study carried out in the county of 'Møre & Romsdal', Norway (Molka-Danielsen, Ohren, & Jæger, 2003), found that there are clear differences between rural and urban areas in the development of broadband infrastructure. 'The aggregation of demand of users in rural communities is often not great enough to justify the investments' (Molka-Danielsen et al., 2003). The cost of developing broadband service is too high relative to the demand. But even if rural areas are lagging behind, the situation is not exclusively negative. In an OECD study of broadband access in rural and remote areas (OECD, 2004), it was found that the results in rural areas are "sometimes surprising and counter-intuitive ... . There is a rapidly increasing amount of new private-sector entry occuring in the provision of broadband access in rural areas" (OECD, 2004, p. 4). These providers are delivering high-quality service at a competitive price. This paper will further examine the development of broadband infrastructure in rural areas.

RESEARCH METHOD
This study of rural broadband infrastructure development is a study of factors contributing to and influencing the development of the infrastructure. An interpretive approach is used to reach a better understanding of the development (Walsham, 1993). Interpretive research is concerned with the development of a deep and contextual understanding of a 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.

The study explores a longitudinal process which covers the years from 1998 until today, and which involves activities at different levels, both regional and local. At the regional level I started out by following the process as a participant observer (Baskerville & Wood-Harper, 1996; Cole, 1991). As the process stabilised my involvement in the development has decreased, and my main source data have been documents, status reports, project reports and applications for continued funding. Data has been gathered as part of the process through the interaction, participation and observation of meetings and activities. In addition three of my colleagues have been active in the process as project managers and change agents; dialogue and discussions with them have been important in filling gaps.

At the local level a combination of interviews with broadband providers and a survey of the various offers of broadband services in the region have been used to gather data. The survey was published in a series of status reports and updated based on developments. Early in the process the frequency of status reports was high, while lately the frequency has become lower. Additional sources of information have included the web sites of the local initiatives, project reports and interviews with some key actors from some of the local initiatives to complete the picture.

The analysis has been carried out using a historical perspective (Granovetter & McGuire, 1998, p. 149). This approach opens up for a degree of uncertainty as the events are interpreted and the interpreter bases the interpretation on the knowledge he/she has about the development; this again can open up for different interpretations. In this case, the interpretation is carried out as a critical reflection by myself as one actor in the network. The aim is to analyse the development of the broadband infrastructure exploring the development process and the factors influencing the development.

KEY THEORETICAL PERSPECTIVES

Information Infrastructure
An infrastructure is defined as "a set of interconnected structural elements that provide the framework for supporting the entire structure. It usually applies only to structures that are artificial" (Wikipedia, 2006). An infrastructure may be looked upon as a network that connects an integrated and heterogeneous set of components, such as equipment, systems, applications, processes and people. But at the same time these components are rather stable structures, with a certain inertia.

An information infrastructure is an infrastructure that supports the information society: the equipment, systems, applications, and support systems etc. needed for operating in the information society. The term *Information Infrastructure* was introduced as part of the National Information Infrastructure initiative launched by the Clinton administration in 1994. In the Clinton – Gore initiative the Internet was described as an infrastructure shared by its users. With the introduction of the Internet as a tool for the general public and for particular purposes there was a need for a construct which emphasises the distinction between Internet-type applications and ordinary information systems. Information infrastructures are according to Hanseth (2000) *shared*, in that they are a foundation for the community they support. They are also *open and enabling*, in that they support a large variety of applications. In addition they are *evolving*, *standardized*, and *heterogeneous*, i.e. both their organisational and technical components are connected using standards or gateways.

The paper will focus on broadband as an information infrastructure. Broadband is both an infrastructure and an information infrastructure because it consists of a set of interconnected components, equipment, systems, applications, processes and people, in more or less stable structures. Broadband is shared between all its users, it supports a number of different applications and its users are aware when it does not function as expected.

Infrastructure cultivation
Infrastructures are heterogeneous networks (Shapiro & Varian, 1999) of technical and organisational components assembled together. The heterogeneity of the network makes them complex to plan and design. Traditionally, telecommunications infrastructures, top-down planned and rolled-out, are managed internally without much interaction with actors who own neighbouring infrastructures. They themselves have full control over the infrastructure, the installed base and how it may be extended. As a result both the technical and organisational complexity of the development may be considered to be relatively low.

In a deregulated market there are new challenges. Depending on the approach chosen the complexity of the development can vary from low to high. Urban areas with a sufficient

market demand will still be served by providers who can roll-out the infrastructure without much coordination with other actors. In rural areas where the market demand is low alternative strategies are needed to achieve the same level of service; this involves more coordination between owners of the installed base and results in more complexity through integrating different technical and organisational systems.

According to Star and Ruhleder (1996) factors such as the conventions of a community, practice and working routines etc. both shape and are shaped by the infrastructure. Consequently, such factors must be taken into consideration in the design process. An infrastructure from this perspective is never developed from scratch; it builds on something and continuously interacts with it (Hanseth, 2002), and when changed or improved, the new version has to fit in with the existing infrastructure. This 'something' is often termed the installed base. The characteristics of the installed base in question will vary depending or whether a top-down or a bottom-up approach to development is taken. In a top-down setting the installed base is controlled by the developer. However, in a bottom-up setting, the installed base may be managed by different organisations and consist of different technical solutions; as a result the complexity of the development increases, and the installed base will also vary from community to community. Consequently, it is impossible to make a blueprint copy that may be used from one location to the next.

Ole Hanseth (2002) has developed a notion of cultivating an infrastructure based on the available installed-base as a bottom-up strategy. The concept of 'cultivation' originates from the sphere of agriculture and means to 'to grow and cultivate plants and the domestication of animals'. In the sphere of information systems the word has been used in relation to strategies for developing technological systems. Dahlbom and Janlert (1996) use the concepts of construction and cultivation to describe two different processes to shape technology. 'Construction' puts emphasis on the human ability to shape the world according to set of goals. 'Cultivation' refers to the process of selecting and assembling components but also to a process of growth or development in the material itself when we create a system. According to Hanseth (2002) cultivation as a concept views technological systems as organisms that have a life of their own, this focuses on the limits of the rational and human control involved in the development.

Hanseth and Lyytinen (2006) define two key design strategies for information infrastructures. Each of these has a defined set of principles and guidelines to make the development process simpler and to increase the success rate of the implementation. The strategy "Bootstrap installed base" considers how to cultivate the infrastructure by focusing on usefulness for the first adapters and the size of the user groups as a way of ensuring momentum and creating a critical mass of users. Another way of building momentum is to extend the available installed base. When building on the installed base the new components need to be simple and inexpensive, but they still need to fulfil the main aim of creating a useful service. They need to fill the connection to the existing entity using an interface based on standards and gateways, but it is also easier for potential users to connect to the infrastructure without making a total break from the known and existing entity. Improvements should be on a needs basis, rather than a "nice-to-have" basis. Throughout the whole process the alignment of interest needs to take place in parallel to the building process; part of this is also a process of developing a support community for the infrastructure. In this way the new infrastructure is built brick-by-brick as part of a bottom-up strategy. The second strategy "Avoid technology lock-ins" focuses on simplicity, modularisation and use of gateways between different layers and components and to neighbouring infrastructures. Lock-in situation is something that can

happen over time as the infrastructure develops. By choosing simple and inexpensive components and designing for flexibility it may be possible to avoid lock-in situations.

Exploring the Installed Base

When dealing with bottom-up cultivation of infrastructure in rural area the complexity is high and there is a need to explore features of the available local installed base before and during the cultivation process. What is the installed base in broadband development? Installed base in general is the available infrastructure – the existing standards, technical and non-technical components needed to develop an infrastructure or develop it further – to cultivate it. An infrastructure is never developed from scratch, it is an extension to the existing installed base (Hanseth & Lyytinen, 2006); therefore there is always an existing installed base that can be cultivated. In a bottom-up process it is necessary to start by examining the installed base in a local community to identify what is the starting point and identify actors that can be aligned and utilised in the cultivation process.

The design strategies (Hanseth & Lyytinen, 2006) for information infrastructures with their principles and guidelines provide guidance for the designers and constructors who are responsible for the cultivation process. They bring us to a certain level where the instruction is to draw on and expand the installed base by using the existing transport infrastructure and building gateways to the existing infrastructure. In the case of local broadband development, the number of local actors controlling the existing installed base may be high, and the number of needs and motivations may also be high. As a result, the development is often complex with a number of actors who need to align and move toward a common aim. One of the challenges is to identify the installed base and consider how to best utilise it in the design process. But how can we identify the available installed base and how can the installed base be utilised in the design? Schön's (1991) "reflective conversation with the situation" offer one such framework. In an effort to identify "the reflective practitioner" he explores the teacher – student relationship in one of the design professions - architecture, which includes urban design, regional planning and town planning. Design processes for infrastructures in general and information infrastructures are met with many of the same challenges that the architect meets when approaching the location for a new development. In search for more information about exploring the installed base I was therefore inspired by Schön (1991) and his "reflective conversation with the situation", which views the process using three dimensions: the design; the implications discovered in the process; and changing stance regarding the situation, going from unit level to considering the whole. This paper uses the framework as described by Schön for architecture to create a "reflective conversation" in relation to broadband infrastructure, and in particular the design dimensions, which may offer a framework for information infrastructure in general.

When an architect is designing a new construction, a house, a campus, the utilisation of a plot, there are a number of existing factors influencing the design – the installed base. Any decision made in the design phase may influence later decisions. In performing this reflective conversation the designer takes different stances in relation to the object and location. Hanseth and Lyytinen (2006) claim that we need to draw upon and expand the existing installed base. However, they do not offer a framework for assessing and reflecting upon the installed base and its influence on the design of the new infrastructure. For the design dimension Schön (1991) describes twelve clusters of elements describing the features, relations and actions related to the architectural design and the norms to evaluate problems, consequences and implications. The descriptive clusters focus on the site, i.e. the factors

which influence the development that are specific to the location, and how components may be organised in relation to each other. They also focus on the use and function of the construction, including the elements that need to be in place. The descriptive clusters are part of a process of making design decisions, but also part of a process of "zooming in and out" from a unit level to the whole as part of a process of considering the design implications from a number of shifting viewpoints.

In the next section we will give a description of the case material and then we will use the cases to explore the descriptive clusters as part of the process of cultivation of the installed base.

THE DEVELOPMENT OF BROADBAND IN SOGN OG FJORDANE COUNTY

Sogn og Fjordane County is located in the western part of Norway, and covers an area of 18,634 square km and with an average of about 6 persons per square kilometre. The county is characterised by a rugged physical environment which includes glaciers, mountains and fjords, which separate populated areas.

At the time of the deregulation, access to broadband infrastructure in Sogn og Fjordane County was very limited. The regional university college, research institution and hospital, all had access to broadband capacity. There were also a few enterprises that leased lines for specific purposes and used ISDN for email and Internet access. However, in other more urban areas both local and national providers offered a number of broadband alternatives.

The industries in Sogn og Fjordane are to a large extent based on natural resources and are often located close to these resources. As a result the population is spread over large parts of the region with only a few agglomerated areas. For commercial providers the cost of cabling the whole region was considered too high and the demand was too small. The providers are willing to deliver access to individual organisations, but at a high cost. To rent a 2 Mbit/s connection is 40 times as expensive per bit as the rent for a 622 Mbit/s (Teleplan, 2003b), accordingly it is a discount based on quantum. Local actors can reduce cost by collaborating if they share a high capacity connection and develop an access network locally.

To meet the challenge a total of twelve regional and local initiatives were undertaken, which utilised existing relational and organisational networks and established new ones where it was needed. These initiatives ensure that large areas of the region now have access to broadband infrastructure. Several of the initiatives were developed as part of a public-private partnership and have received funding from Høykom and from the public sector. Nine of these initiatives have been included in a study carried out by Norsk Telecom (2004). Table 1 lists all the initiatives with a short description of their main characteristics. As result of these initiatives the region has a broadband DSL coverage of 79.36% (Telenor_Jara_AS, 2006). However, among the regions 26 municipalities the coverage varies from 34.51% to 97.16%. Figure 1 below shows the development of broadband access from 2002 to 2006 in Sogn og Fjordane County.

Table 1 Overview of local broadband initiatives and suppliers in Sogn og Fjordane as of June 2006. The two initiatives marked with * are chosen for consideration in this paper.

| Initiative	BB since	Owners/ involvement	Infrastructure	Users/Use	Operation	Coverage municipality
Aurland & Lærdal breiband	2003	Ltd owned by 2 Municipality + 2 el. suppliers	Existing cable-TV &ADSL & wireless & fibre	Sogn Breiband	Internal operation	Aurland & Lærdal
Datapart	2002	Ltd company	Wireless & ADSL	Private & businesses	Internal operation	Luster & Sogndal
Enivest	2000	Ltd owned by 4 municipalities and 3 el. suppliers	ADSL & wireless & fibre	Private & businesses	Internal operation	Nine municipalities
Firdanett *	2000	Ltd company owned by el. supplier	ADSL & wireless	Private & businesses	Internal operation	Gloppen
Jølster Breiband	2002	Ltd company	Wireless	Private & businesses	Internal operation	Mainly Jølster
Kapasitets-laget *	2000	Ltd Company	Fibre	Businesses & public sector	Outsourced operation	Sogndal, Leikanger, Luster
Sogn Breiband	2005	Ltd company	Services on top of ALB	Private & businesses	Internal operation	Aurland & Lærdal
SicoData	?	Ltd company	Wireless & ADSL	Private & businesses	Internal operation	Stryn
ViaVest	2000	Ltd joint venture between companies	Wireless & leased lines	businesses	Internal operation	Stryn
Vik IT-Partnar	2002	Ltd company	Wireless	Private & businesses	Internal operation	Vik Balestrand in coop. w el. supplier
Zet.no	1998	Ltd company	Wireless & fibre	Private & businesses	Internal operation	5 towns
Årdalsnett	2001	Ltd company 12 local owners	Existing cable-TV & wireless	Private & businesses	Internal operation	Årdal & Lærdal

Figure 1. The map on the left shows access points for broadband coverage in 2002 and the one on the right shows the coverage in 2006 (Vorland, 2006).

Each of these initiatives covers only a part of Sogn og Fjordane and all are the result of local initiatives. The company Enivest is the only entity that may be considered to be a provider with regional coverage. The national provider Telenor is currently present in all 26 municipalities in the region, providing DSL service (BBF, 2005).

In addition to the local initiatives there is a regional initiative called Broadband-forum Sogn og Fjordane (BBF); this is a network organisation which was initiated in 2001. BBF focuses on the establishment, development and utilisation of broadband infrastructure in local communities. BBF initiates and participates in activities, focusing on disseminating information by means of meetings and conferences. It maintains an overview of providers in each municipality, and monitors projects by focusing on utilisation and service delivery. By participating in these activities BBF supports the demand side in achieving the aim of having the best possible coverage in the region.

The following description focuses on two of the local development initiatives in the municipalities Sogndal – Leikanger and Gloppen (marked with * in Table 1 above). These two localities had different starting points (different installed bases) and also went through different processes subsequently (the differences are further outlined in Table 3, below).

Sogndal – Leikanger municipalities
Sogndal Municipality is one of the main agglomerations in the region, with about 6,600 inhabitants. It has a diverse business structure, and is also the location of the regional university college and a small research institute. These two institutions both had access to broadband prior to deregulation. As the university college developed, it grew to occupy various buildings throughout Sogndal; over the years a broadband infrastructure has been built which connects these various buildings. This infrastructure originally leased lines from the national telecom provider Telenor, but with the liberalisation of the market, the university college and the municipality purchased the available infrastructure.

Below is a chronological list of the main events involved in this development process in Sogndal – Leikanger.
- 1996 – today: two large public organisations, the county municipality[3] and the county governor[4], participated in international projects together and separately, in the development of national eGovernment services.
- 1999: increasing need for better, faster access to Internet The need for high capacity access to provide services to regional and national users. Services generate heavy traffic both with regard to large files and the number of requests, e.g. the portal norge.no, which has approximately 55,000 page views per day[5]. The two public organisations, along with regional partners, saw an opportunity to achieve sufficient access at lower cost by aggregating demand.
- 1999: Applied for funding from the national programme Høykom. The project started June 1999 and was finalised in December 2001. The focus was on developing the local infrastructure to facilitate service delivery.
- 1999-2001: A network structure was set up to connect the two public organisations located in Leikanger to the national trunk network in Sogndal with a 2 Mbit/s and a 4 Mbit/s line. The 20 km line to Leikanger from Sogndal was established by leasing lines

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[3] Norwegian: *Fylkeskommunen*: Sogn og Fjordane County Municipality – political and administrative regional organisation.
[4] Norwegian: *Fylkesmannen*: The county governor in Sogn og Fjordane – the regional state representative
[5] Calculated based on data from http://www.norway.no/omnorgeno/statistikk/norgeno.asp? [Accessed 20.9.2006]

from the national provider. Subsequently they rented un-terminated fibre, to obtain more control over capacity and both endpoints. In Sogndal there was a 4 Mbit/s line to the university college, and the connection to the national trunk network was 4 Mbit/s.

- 1999 -2001: In Leikanger a backbone network was developed in 2 phases to include 16 nodes locally, consisting of fibre and radio links.
- 1999-2001: The county municipality extended their network to include the administration of nine municipalities in the region. The virtual private network (VPN) had a capacity of 2 Mbit/s and a common firewall.
- 1999-2001: In Sogndal two R&D organisations were connected with a 4 Mbit/s line. Eight businesses cooperated in a joint effort to create a backbone network consisting of fibre and radio to extend the common infrastructure to other potential users.
- January 2001: A joint venture company 'Kapasitetslaget i Sogn AS' (KL) was set up. Its aim was to continue operation and development. Ten local companies own equal shares in KL.
  The combination of owners ensured access to the installed base and to knowledge about how to operate the infrastructure. Initially KL was operated using employees from the participating owner organisations. Later the operation was out-sourced to one of the organisations.
- 2002: The access network was extended to the neighbouring municipality Luster. A new fibre line was needed. This was made possible by a joint effort between two local energy companies and the main national telecom provider, utilising existing fibre and adding a relatively short new fibre cable. As a result, Luster municipality acquired commercial broadband at least one year earlier than planned.
- 2003, summer: a new piece of fibre cable infrastructure was installed to connect Kaupanger; this infrastructure is owned by a local energy company.

The key to the development's success was the ability to make use of existing fibre infrastructure owned by the municipality and the college. It was also possible to keep the operational costs low by using existing employees from the owner organisations. The collaboration between KL and the owners of the infrastructure was a win-win situation. Compared to traditional top-down diffusion of infrastructure development this approach worked well: it was instrumental in keeping cost to a minimum while providing broadband services in a very short period of time.

Under this setup KL provides the backbone infrastructure; they do not provide any other services. Provision of other services has been left to the users of the infrastructure. Organisations that wish to connect to the infrastructure may do so at their own cost or through a radio line delivered by one of the service providers in the network. KL negotiates access to the national infrastructure at regular intervals. As the use of the infrastructure increased higher capacity access to the national trunk network was needed. Currently the capacity is 20 Mbit/s. The experience so far is that working jointly in this way has led to cheaper and faster access for all of the companies connected through KL.

Summing up this initiative, the main actors and the first adapters in the KL initiative were from the regional public sector, together with a limited number of enterprises and the two local research and educational institutions. The strategy chosen was ad hoc. The main focus was on the needs of the first adapters. The needs of the first adapters and the aim of less expensive broadband capacity were the main motivating factors behind the well-aligned network. There was prior knowledge about operating broadband infrastructure, and the organisations involved had a large knowledge base to draw on. In addition, the infrastructure

was cultivated based on the utilisation of existing infrastructure, unused fibre optic links from former installations and un-terminated fibre cables which were supplemented with some new components to connect the new broadband access network. KL has no employees; initially the operation of KL was based on human resources drawn from the participating organisations, while consultants stepped in to manage administrative and operational services later on. Consequently, the focus remained on the needs of the first adapters, and the economic aspects of the operation were not a problem.

Gloppen Municipality

Gloppen is a municipality with a population of 6000. The development of the local broadband initiative Firdanett is the result of several interacting processes. Below is a chronological list of the main events involved in this development process in Gloppen.

- 1996: the chamber of commerce was revitalised and with it a strategy for revitalising the economic development of the community (Gloppen-Næringsorganisasjon, 2001). This started a process that led to a consensus about the current situation and the future challenges. The Chamber of Commerce worked in co-operation with the municipality.
- 1996: A Gloppen-based ICT firm set up a LAN to provide services to a customer located in one building. They had received requests for an extended service to customers not located in the same building. Due to certain legal regulations this was not possible.
- 1998: The telecommunications liberalisation policy was implemented. The regulations were changed and the LAN was expanded. The LAN and its services formed the basis for the development of the local broadband infrastructure.
- 1998: 'Gloppen IT nett' was established as a joint venture between the chamber of commerce, the municipality and the local energy company (Gloppen-kommune, 2000).
- 1999: An application for funding was made to the Høykom programme. The project started in June 1999 and was finished in December 1999. As part of the project the LAN was extended to become a full broadband access network. The project was important in helping to expand the network to provide better coverage throughout the municipality. The development of 'Gloppen IT nett' was considered to be an exemplary model (*Samferdsledepartementet*, 2002) for public-private partnerships for the development of broadband infrastructure.
- 1999: After about one year of operation it became clear that there was a disagreement amongst the owners with regard to priorities. As a result services connected with the infrastructure, such as backup, server space etc. were transferred back to the local ICT firm, while the remaining owners refinanced the company (which also changed its name to Firdanett at that time). The local energy company was the majority owner of Firdanett, while the chamber of commerce and the municipality were minority owners. Firdanett had two employees, one technician and one salesman.
- 2003: Firdanett provided broadband access to 55 companies and 85 households. At that time the national provider Telenor did not offer broadband to households and small businesses in Sandane.
- March 2004: Firdanett merged with another broadband company, ENIVEST, and as a result of another merger process the two companies came under the same ownership. ENIVEST had regional coverage and expanded their access services based on demand and public sector projects, which were important for development. Coverage in Gloppen was increased further after the merger.

The local broadband infrastructure consists of a mixture of the early LAN, supplemented by fibre cables connecting the main buildings in the central parts of Sandane and radio

transmitters/receivers to reach communities elsewhere in the municipalities. Firdanett has access to national infrastructure through a 6 Mbit/s licensed radio link to Hunvikfjellet that is about 22 km (straight-line distance), which connects the local network to the national trunk network. In Gloppen the LAN was the only technical installed base that could be cultivated in the same way as in the KL case. The cost of putting a fibre optic infrastructure in place was high and there was no short term payback from the investment.

Firdanett offers broadband Internet access and IP telephony, and the ICT firm and other service providers offer their ICT services to the businesses connected to the network along with other service providers such as accountants.

Summing up this initiative, the main actors in the Gloppen initiative were local enterprises and the local public sector. The strategy chosen was ad hoc and the main focus was on the needs of the business community. The main motivating factor was access to broadband infrastructure for a relatively low number of organisations; as a result there was an immediate need to increase the number of users quickly which made the development more difficult. As a result, the local network was not well aligned at the start; however, after the restructuring it became a well-functioning initiative. The initiative had IT competence but little experience in operating this kind network, and there was no common knowledge base. Because it was necessary to have sufficient income to employ staff – two persons were employed to operate and market the infrastructure – this put pressure on the organisation, as the focus became income generation as opposed to the needs of the first adapters.

CAN DESCRIPTIVE CLUSTERS BE USED TO EXPLORE THE INSTALLED BASE ?
Both the cases described above are successful developments, but the conditions for the developments were quite different. Out of the twelve initiatives in the region, these two have been chosen in order to represent some of the variety that was present. Common to all is the bottom-up approach, including the approach of making development as simple as possible using available infrastructure and low cost additions to fill the needs of the first adapters. In effect, these developments create a larger total market for suppliers than that constituted by the individual needs of the actors, i.e. they aggregated the demand. This involved a public-private partnership sharing costs between regional and local public sector and local businesses. Transaction costs are also lower for suppliers, who interact with the initiative as one large customer rather than many small customers.

The variety in the development process illustrates the need to take specific local factors into account; this includes the needs of the potential first adapters, the existing infrastructure (installed base) which is available to be built upon (both technical and organisational), and the local organisation(s) which are part of the installed base. This is where I suggest that Schön's (1991) "reflective conversation with the situation" may be useful. In Table 2 the twelve clusters defined by Schön are listed and redefined for the local broadband context. Most of the descriptive clusters are also useful when working with rural broadband infrastructure, but some seem to not be applicable or to be variations of one of the other clusters. The original twelve descriptive clusters (Schön, 1991) have been examined, combined and redefined into ten descriptive clusters which cover areas relevant to the local broadband context. There are small variations between the original cluster 3 'Building elements' and cluster 6 'Structure/ Technology', and also between cluster 4 'Organisation of space' and cluster 5 'Form'; therefore the proposal is to use ten clusters as opposed to the twelve defined by Schön (1991).

Table 2 Mapping of Schön's (1991) descriptive clusters with the clusters found useful for rural broadband development

Descriptive cluster w/ explanation according to Schön (1991)	Cluster broadband development	Definition of cluster for broadband development
9) **Character** - the kind of, mode of, or style of construction	**Character**	*Kind of infrastructure*
1) **Use and function** - what is the intended use or function of the construction	**Use and function**	*Description of intended function and use of the infrastructure*
2) **Siting** - Features of the site, factors that influence the development	**Siting**	*Descriptions of the site(s) to be served by the infrastructure. If relevant description of neighbouring infrastructure, of geography or structural features that can influence the infrastructure and of organisations or actors that can play a role in bootstrapping the infrastructure.*
10) **Precedent** - describing a model for the construction;	**Precedent**	*Models for the implementation, reference types.*
3) **Building elements and components** - what needs to be in place and can be used in the construction;	**Technology, building elements and components**	*List of possible components. Design principles for development.*
6) **Structure/Technology and processes used** - the material needed in the construction and an understanding of the process		
7) **Scale** - Magnitudes of elements in relation to one another	**Scale**	*Reach and capacity of infrastructure, bandwidth, coverage %, coverage geography*
4) **Organisation of space** and the relation of spaces to one another	**Form/ Organisation of space**	*The shape of the infrastructure, distribution, redundancy, M:M or 1:M How and were are different places that will be using the infrastructure located, how can they be connected?*
5) **Form** - Shape, geometry, organisation of space and paths through space		
8) **Cost of development;**	**Cost of development:**	*Budget available for the development and for operations.*
11) **Representation** - Language and notions for describing the construction	**Representation:**	*Representation used to describe infrastructure*
12) **Explanation** - context of interaction.	**Explanation**	*Protocol for frequency and involvement of users in the development process.*

When developing rural broadband infrastructures, what is the installed base and what are the input factors to the bottom-up cultivation process? In Table 3 the two local initiatives are described using the redefined clusters. This is done to enable the extraction of important factors relating to the cultivation process and to identify rhetorical 'what if' questions, taking the installed base and the features of the location into the consideration in the cultivation process. The descriptions shed light on the installed base, the choices made and components used as part of the cultivation process.

Table 3 Description of the two cases using modified clusters

Descriptive cluster	Firdanett	Kapasitetslaget
1) Character of information infrastructure:	Internet access, service platform	Internet access
2) Use and function	Phase 1. Access to Internet & service provision public sector and businesses in centre. Phase 2. extending to also cover private homes and businesses outside centre. Function: 1)Provision of services locally on the network, 2) Gateway to services on the Internet	Access to Internet to deliver services to external customers. Cover needs of initiators. Function: Gateway to services on the Internet and provision of services to users on the Internet. . Negotiating power increase/lower total cost?
3) Siting:	Municipality of Gloppen, Phase 1. Centre of Sandane, public sector + businesses. Phase 2. Byrkjelo, Reed, Austrheim, Vereide, Rygg and Hyen, schools + general public. Installed base: LAN inside buildings, Telephone lines, Organisational: Municipality, energy company, chamber of commerce and some businesses interested in leading the development. Knowledge: Had sufficient operational skills, but very dependent on individuals and one company. Received external help to get funding. Needed to employ service personnel and a manager to operate the network. Salaries were the main costs of the company and put pressure on company's economy.	Municipalities Sogndal and Leikanger, specific organisations. Later also extending to other neighbouring communities, Luster, Kaupanger. Installed base: Municipality and university college own fibre network covering much of Sogndal Centre. Access point for national trunk network in Sogndal. Knowledge: Partners in the development had across organisations skills and knowledge about running and extending the networks. Did not need to employ personnel to manage the network - was in the start-up phase operated based on "donation" of time from employer to KL. This kept the operation costs very low.
4) Precedent:	Internet	Internet

Table 3 cont. Description of the two cases modifies clusters

Descriptive cluster	Firdanett	Kapasitetslaget
5) Technology, building elements and components	Licensed Radio link to Eid to connect to national trunk network. Optical fibre in Sandane centre, licensed radio link and wireless broadband to the subscriber to connect more of the surrounding and remoter communities.	Fibre owned by university college available, leased lines to Leikanger connecting county municipality (*Fylkeskommunen*) and county governor (*Fylkesmannen*) to network. Leikanger installed trunk network in 2 phases to include 16 nodes locally; consists of both fibre and radio link. Use gateways to connect fragmented infrastructures. Extending to Luster and Kaupanger in collaboration with national provider, and two local electricity companies.
6) Scale,	Reach: Phase 1. Centre of Sandane, businesses & public sector. Phase 2: Small communities in municipality Gloppen, businesses and private homes. Bandwidth (initial): 10/100 Mb to trunk network. In the network aiming for 2-11 Mbit capacity using radio links.	Capacity on the link to national trunk network, determining the cost of KL services. Dependent on number of connected users, and type of data. Transfer of music files requires high capacity, web search requires lower capacity. Access to trunk network needs to be scalable to fit number of users and the demand of the users connected to the infrastructure.
7) Form/ Organisation of space	Centre of Gloppen Sandane is located about 20 km from a location to connect to national trunk network. 2 possible trunk network providers. Star shaped infrastructure, no redundancy. Unlicensed radio and fibre are alternatives for distribution to end user.	Sogndal is on the national trunk network. Leikanger is 20+ km km from Sogndal. Luster 10-15 km, Kaupanger 10 km. Star shaped infrastructure - no redundancy
8) Cost of development	Cost of putting down fibre and setting up radio link and radio. Cost of serving an IP phone switch. Funded among others through 2 projects. Phase 1: 1.8 million NOK. Phase 2: 1.66 million NOK	Cost of connecting fragments, cost of gateways. Project phase: 2.9 Million NOK
9) Representa- tion	No particular representation chosen	No particular representation chosen
10) Explanation	Aim of development to ensure broadband access to Internet for public sector, businesses and individuals.	Aim of development to ensure broadband access to Internet for public sector, businesses and individuals.

Table 4 Redefinition of descriptive clusters for the infrastructure domain, (modified from Schön (1991))

Cluster	Important questions to ask
Character	*Kind of infrastructure.* What kind of infrastructure is intended?
Use and function	*Description of intended function and use of the infrastructure* What is the intended function? What is the intended use? Who are the intended users? (Public sector/ business/ private)
Siting	*Descriptions of the site(s) to be served by the infrastructure. If relevant, description of neighbouring infrastructure, of geography or structural features that can influence the infrastructure and of organisations or actors that can play a role in bootstrapping the infrastructure.* Where is the installation? Location of sites to connect? What is the installed base? What organisational infrastructure can be utilised? Is there sufficient knowledge and competence to operate infrastructure? Who has this knowledge and competence? Who are the first adapters? Are there other potential first adapters that are instrumental to be included? Which facilities need to be connected to the new infrastructure? What are potential growth paths? Who are potential second adapters?
Precedent	*Models for the implementation, reference types.* Has anyone done something similar before? Is it possible to learn from them and their choices? Study trip?
Technology, building elements and components	*List of possible components. Design principles for development.* Which components is it possible to utilise? Hardware (Fibre, licensed and unlicensed radio, copper phone lines…, DSL). Standards, switches, organisation. Structure and basic choice of technology and development process.
Scale	*Reach and capacity of infrastructure, bandwidth, coverage %, coverage geography.* What bandwidth is needed? What is the geographical coverage? What is the percent coverage?
Form/ Organisation of space	*The shape of the infrastructure, distribution, redundancy, M:M or 1:M How and were are different places that will be using the infrastructure located, how can they be connected.* Possible designs taking technology, building elements and components, scale and costs into consideration. Should there be redundancy in the system? If this is the case how and where are the critical applications / users?
Cost of development	*Budget available for the development and for operations.* Cost of alternatives? Can the development be phased? What human resources are needed? Is there access to these resources? How can the project be funded? (Public funding, first adapters, dependent on critical mass of users.) Budget available for the development and for operations?
Representation	*Representation used to describe infrastructure.*
Explanation	*Protocol for frequency and Involvement of users in the development process.*

CONCLUSION AND PRACTICAL IMPLICATIONS

Using a bottom-up strategy is more complex than a top-down roll-out, because there are many actors and components to consider. Hanseth and Lyytinen's (2006) framework and Schön's (1991) descriptive clusters are intended to serve as a framework for both understanding and guiding bottom-up development. In the description of the cases it has been used in retrospect to examine the development. Looking at the information brought forward in the description (Table 3) of the cases, it is possible to extract a number of questions that are useful to consider when starting a bottom-up process. In all of the cultivation processes there will be uncertainties. To reduce the uncertainties it is necessary to know as much as possible about local conditions and potential actors that the project should be aligned with, as well as the installed base; which components need to be added to the installed base as part of the cultivation must also be carefully considered. During the cultivation process the descriptive clusters may be used to arrive at a description of the installed base and the considerations needed to cultivate it. To identify the opportunity space of the local broadband development, the descriptive clusters become a tool, a set of rhetorical questions for uncovering the installed base and the choices that need to be considered, i.e. the "what if" and "if … then …" considerations that need to be taken as part of the cultivation process. In Table 4 the local broadband clusters are analysed to produce a set of questions addressing key contributing factors to a bottom-up cultivation of broadband infrastructure.

In this way the descriptive clusters may be used to uncover the starting point of a development. The questions and answers describe important inputs into the development process, and in using them it is possible to gain an overview of what kinds of resources are available, of the features installed base and of the kinds of decisions that need to be taken. In addition, the use of a tool like the descriptive clusters also puts the focus on the local context and culture in the community. With a bottom-up strategy questions have to be answered in relation to the local context. When changing from one location to another there are always things to be learned, but the bottom-up strategy makes it impossible to make blue-print implementations. What can be transferred are rather the relevant methods and experience of dealing with a type of problem situation.

KEY TERMS AND THEIR DEFINITIONS

Broadband – High speed data transmission. There is no clear definition of what constitutes a
broadband transmission. Some definitions only consider speeds above 2 Mbit/s, while in this
document speeds above 384 kbit/s are considered as broadband, while ISDN and modem
transmissions fall outside the definition of broadband.

Cultivation – A strategy for developing technological systems. The term originates from the sphere of
agriculture and means to 'to grow and cultivate plants and the domestication of animals'.
Dahlbom and Janlert (1996) use the two terms "construction" and "cultivation" to describe
two different processes to shape technology. "Construction" emphasises the human ability to
shape the world according to set of goals. 'Cultivation' refers to the process of selecting and
assembling components, but also to a process of growth or development in the material itself
that has characteristics that influence the development.

Høykom – A Norwegian programme to increase the demand for broadband services. The Høykom
(www.hoykom.no) programme is at present in its third period of operation. The programme
was initiated in 1999 for a period of three years (1999 - 2001). Its current period of operation
lasts from 2005 - 2007. Høykom has provided financial support for more than 400 projects on
a shared financing basis. Høykom supports projects initiated by the public sector with up to 50
percent of total project costs, totalling more than €45 million and has led to a total project
volume of more than €130 million.

Infrastructure – A 'set of interconnected structural elements that provide the framework for supporting
the entire structure. It usually applies only to structures that are artificial' (Wikipedia, 2006).
An infrastructure may be viewed as a network that connects an integrated and heterogeneous
set of components – such as equipment, systems, applications, processes and people – while at
the same time these components form rather stable structures with certain inertia.
Infrastructures are often taken for granted; their existence is only noticed when a segment
breaks down, e.g. during a power outage. There are many types of infrastructures:
- transportation, such as roads and public transportation
- public utilities, such as telephone and electricity networks
- public services, such as fire departments, police, waste management
- national services such as defence, postal services and the national bank

Information infrastructure - An infrastructure that supports the information society: the equipment,
systems, applications, support systems etc. that are needed for operating in the information
society. The term was introduced with the National Information Infrastructure initiative
launched by the Clinton administration in 1994. In the Clinton-Gore initiative the Internet is
described as an information infrastructure shared by the users.

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Overview of book towns

Appendix G

Overview of book towns

Opening year	Book town	Country
1962	Hay-on-Wye Book Town	Wales
1984	Redu, le Village du Livre	Belgium
1988	Bécherel, Cité du Livre	France
1989	Montolieu, Village du Livre et des Arts Graphiques	France
1991	Kembuchi Children's Picture-Book Village, Hokkaido	Japan
1993	Bredevoort Boekenstad	Netherlands
1993	St. Pierre de Clages, Village du Livre	Switzerland
1993	Miyawaga Children's Book Village, Gifu	Japan
1994	Stillwater Booktown, Minnesota	USA
1996	Sidney-by-the-Sea, British Columbia	Canada
1996	Fontenoy-la-Joûte, village du livre	France
1996	Fjærland, Den norske bokbyen	Norway
1997	Damme Boekendorp	Belgium
1997	Mühlbeck-Friedersdorf Buchdorf	Germany
1997	Wünsdorf Bücherstadt, Waldstadt	Germany
1997	Sysmä, Kirjakilä, bookvillage	Finland
1997	Kampung Buku Langkawi, Kedah	Malaysia
1997	Gold Cities BookTown, Grass Valley, Nevada	USA
1998	Wigtown Booktown	Scotland
1998	Dalmellington Booktown	Scotland
1999	Cuisery, village du livre et des metiers du livre	France
2000	BookTown Australia, Southern Highlands	Australia
2000	Villerville-sur-mer village des livres, Calvados, Normandie	France
2000	Montmorillon, La Cité de l'Ecrit et des Métiers du Livre, Vienne	France
2000	Grythyttan-Hällefors Bokstad	Sweden
2001	Montereggio, Toscana	Italy
2001	Mellösa Bokstad	Sweden
2003	Tvedestrand Bokbyen ved Skagerrak	Norway
2004	Booktown Blaenafon	Wales