

**Department of Media
and Communication**

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**Exploring Hybrid
Communities**

Telecommunications On Trial

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Exploring Hybrid Communities

Telecommunications On Trial

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Preface

This book is the result of my research at the Roskilde University Programme of "Technology Policy, Innovation and Socio-Economic Development". I wish to thank the members of this programme. Their open and unveiled criticism helped me to complete the work. Special thanks go to Lars Dencik and Knut Holtan Sørensen for all their help and advice.

Thanks also to "the actor-network" of the "Dutch summer school of STS" at Twente University, the Netherlands. I spent several very stimulating weeks there, guided by Bruno Latour and others into the "Semiotic Turn in Science and Technology Studies and Beyond".

The research is based on four case-studies of experimentation with telecommunications. This has brought me to a variety of places and in contact with many people in both Norway, other Nordic countries, the International Telecommunication Union and in Bénin. The empirical results are reported in different reports and articles. The cooperation with all these people in the "field" has constantly been in my mind when I have struggled to bring my experience together in a more coherent framework.

Further, I thank colleagues at my former home institution, Hedmark College, and collaborators at Finnmark College, Rogaland Research Institute and Eastern Norway Research Institute for having participated in both projects and discussions in recent years. Finally, my warm thanks to Roger Leys who has improved my English and made it more readable.

The final writing period was made possible by a grant from the Norwegian Research Council. An earlier version of this thesis was submitted to the University of Roskilde in 1994. Subsequently, I have added chapter 2. In spite of the intellectual debts, responsibility for the final text is, of course, my own.

I dedicate this work to my wife, Hilde, and my two sons, Jo and Svein, who made our stay at Sct. Jørgensbjerg into a most active and memorable encounter with Danish society.

Oslo, November 1996

Per Hetland

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1. Introduction-Exploring Hybrid Communities

This book focuses on some of the interactive aspects in the process of shaping technology. The analysis takes as its starting point two important characteristics of the emergence of new telecommunications: 1) the highly developed capability of the modern economy to produce and diffuse user-values with new characteristics and 2) "hybrid communities"¹ as quasi-experiments² making an arena for interaction between users and producers. In hybrid communities, potential user needs and potential user-values of new technology and new services are communicated between users and producers to facilitate invention and diffuse innovations.

As small children we are told fairy tales about the heroine or hero who passes the test and wins the prince or princess. Norwegian boys and girls are told stories about Cinderella or Numskull Jack, that before the test gather together a network of strange artifacts and supporters. For helping the unfortunates and outcasts they are given small tokens of appreciation, and together with more or less haphazardly collected elements they build associations of artifacts and supporters. With these strange, but strong associations they create new opportunities for problem solving and overcome time and distance, and not least all conceivable ordeals. Finally, the losers are reframed as the winners and win the prince or princess.

The telecompanies of the industrial world, political authorities and entrepreneurs have in recent years tried to invite users into hybrid communities bringing with them - as Numskull Jack or Cinderella - a natural naïveté and an open mind in the hope of sparking off a creative process that should result in new services and new technology. However, these hybrid communities have had only a limited success and one interpretation for the "failure" could be that they do not manage to build the necessary associations between artifacts and supporters.

In the following, I will therefore look closer at how the different actors in hybrid communities manage to build associations of artifacts and supporters. I will in this study walk in the footsteps of some small activities of the telecompanies - *the producers' activities to develop telecommunication services*

for rural areas as part of their general development of telecommunication technology. Generally speaking, telecommunication services in remote and rural areas yield lower returns, they may even lose money and have to be subsidised. For this reason the development of rural telecommunications is usually highly dependent on policy measures.

My aim is to understand the nature and status of hybrid communities and their intellectual products. The questions I seek to answer are found at three interrelated levels:

1) At the level of actors and artifacts:

How do the different actors participate in and shape the outcome of hybrid communities and how is the same technical artifact understood by different relevant social groups?³ One important problem, however, needs a broader discussion, and that is the problem of how to penetrate the obvious and allow the *needs* of actors in a given setting to be described.

2) At the level of hybrid communities:

How do different scenarios of technology development influence the perception of technological possibilities among producers, policy makers and end users? Furthermore, how do different experimental strategies influence the production of facts and artifacts?

3) At the level of policy and practice:

The discussion of how actors participate in an ongoing interpretation process is conditional on the understanding of how hybrid communities find their resolution and "closure". Therefore, how is the experience gained from hybrid communities understood and how is this experience translated into practice and policy?

The more overall aim behind these questions is twofold:

1) To enhance the micro level understanding of technological development by applying the translation model in innovation research. One contribution in this respect has been to demonstrate the importance of *including contextual and cognitive factors through the concept of frame.*

2) How to understand hybrid communities *as part of* the innovation process.

Underlying these questions and aims is a central claim in this study:

innovations in hybrid communities may be better explained by the translation model than the diffusion of innovation model. The translation model explains innovations as temporary interpretations of nature, of technological potentials, of the strategies of competitors in the market and the different interests.

Telecommunications - Modernisation or Hybridisation?

Telecommunications have throughout history been understood in two competing paradigms. The first, which is found both in popular writings and science fiction, but more importantly also in research and policy papers - I will call *the modernisation paradigm*.⁴ In this paradigm, old ways of communication are substituted by the new technology. When I reach for the telephone I am at the same moment transferring a major effort into a minor one. This very strong delegation of activity to a non-human, a telephone, is perceived as the most promising element of modern industrial society. This view is also found in both old and modern advertisements for telephones and other services.⁵ The main idea is that the new technologies substitute travel, post and other ways of communication and thereby extend modernity to even the most remote places. Imbedded in this modernisation paradigm one finds the diffusion of innovation model.

In the diffusion of innovation model the focus is on the process by which an innovation is communicated through certain channels over time among the members of a social system. More generally, as Rogers has described, there are a variety of factors that seem to promote the adoption of innovations: relative advantage over previous methods; compatibility with the adopters' values; the complexity of understanding and using the innovation; the possibility of testing the innovation on a limited basis; and the visibility or demonstrability of the results to others.⁶ This epidemic approach imagines diffusion as a shift of the demand curves caused by the spread of information from early adopters to late adopters who are made aware of the innovation by the use of early adopters.

The competing paradigm, I will call it *the hybridisation paradigm*, claims that although some ways of communication may be substituted, the most

important quality of new communication technologies is the fact that it creates more communication, e.g. new communication technologies may substitute for travel of the most trivial sort. However, the sheer fact of introducing new communication technologies will also stimulate travel. The “hybrid” has added a “sixth-and-a-half sense”⁷ and thereby extends the capacity for communication and action. By these extensions, the new “hybrids” blend their communication activities so that they all in all communicate more, and thereby also old forms of communication activities may increase. One may therefore speak of a synergy effect, resulting in both more travel, etc. and more use of telecommunications. Latour suggests that “modern knowledge and power are different not in that they would escape at last the tyranny of the social, but in that *they add many more hybrids in order to recompose the social link and extend its scale*”.⁸

Technological change is therefore neither additive nor subtractive or substitutive – it is ecological. Ecological in the same sense as in the ecology of biological systems. If one adds, subtracts or substitutes one significant factor then the whole system undergoes a change that affects many other factors. This paradigm is more commonly found (more or less implicitly) in the social sciences, and explanations deriving from this paradigm may explain why dramatic forecasts of declining business travel, etc. never became reality even if a wide range of artifacts has been added to our repertoire. To understand innovation in the hybridisation paradigm I will apply the translation model, which will be presented briefly later in chapter 1 and more extensively in chapter 3.

Understanding Hybrid Communities

When humans extend their abilities to act by the application of technology, they create new forms of hybrids. Donna Haraway suggests the notion of a “cyborg” to describe the hybrid of machine and organism, a creature of social reality as well as a creature of fiction.⁹ The extension of both human senses and abilities made by telecommunications makes the interlinkage of the user and the technology a “hybrid” or “seamless web”. The notion of hybrid should not, however, be limited to the interlinkage between advanced technology

and human beings. The notion should also include the interlinkage between humans and the uses of both apparently simple tools and modern machinery as, e.g. the stone axe or snowmobiles. Two classical contributions in this respect present descriptions of the Yir Yoront when they use their stone axes, or the Saami when they use their snowmobiles.¹⁰

These hybrids represent a blend of humans and artifacts, often by the combination of resources never previously combined. In its biological meaning, the term hybrid implies a mixture of at least two sources. However, it seldom represents an important evolutionary step. But, some processes of hybridisation are more dramatic than others, and tend to be more like mutations than hybrids. In technological terms this is similar to the notions incremental and radical innovations: incremental innovations being all the small steps a certain technology passes through, while radical innovations entail a shift in technological development with generic abilities, generating changes in whole families of artifacts or completely new families of artifacts. I will not, however, delimit the concept "hybrid" by the biological metaphor, but will let the concept reflect the diversity of possible combinations between humans and artifacts; be they either incremental or radical.

This fast growing number of mixtures between humans and artifacts may be illustrated by the following. In the United States alone, more than 4.7 million patents have been issued since 1790. If each of these patents counted for the equivalent of an organic species, then the technological world can be said to have a diversity three times greater than the organic world.¹¹

Not only may the blending of technology and humans create new hybrids, but the blending process may also change our abilities to create social networks, meeting places and even communities. However, not only humans, but also artifacts, participate in the constitution of these communities. One example is computer enthusiasts who belong to a group of people sharing the same interests, through the e-mail system or by similar devices they are able to create a "virtual community" independent of place and time. These virtual communities depend on the use of technology, the technology therefore partakes in the constitution of the community and thereby assumes the role of an "actant". The importance of the concept of an "actant" is that it cracks the wall between the social actors (who possess reasons and intentionality)

and artefacts (which may “act”, but without purposes of their own). Both the humans and the artefacts are therefore actants in the “hybrid community”.

One may claim that in this respect all communities are hybrid communities, like the Yir Yoront and their stone axes, especially since Sharp claims that the stone axe was not just a simple tool, but important for trade, religious belief and social relations just to mention some of the many aspects. However, the notion “hybrid community” does not simply denote a social community that utilises technology in a certain manner, but should be seen as *an artifact in itself* created for the purpose of exploring and possibly also speeding up the hybridisation process. Adapting Escobar’s discussion of Cyberia, I will perceive the hybrid community as composed of elements that originate in three different domains with permeable boundaries: the organic, the technical (or technoeconomic), and the textual (or cultural). While nature, human bodies and biological organisms certainly have an organic basis, they are increasingly produced in combination with machines, and this production is always mediated by scientific narratives (or “discourses” of biology, technology, etc.) and by culture in general.¹²

Hybrid communities are thereby experimental in their very nature and the word experiment denotes a test, as when one experiments with teleconferences to see if this makes the working day more productive. By teleconferences one may be able to replace time consuming travel. The notion of a “trial” or deliberate manipulation is also linked to experimenting. Actually, teleconferences could be the most direct way of evaluating how productivity changes. There are, of course, both deliberate and unplanned trials. The Gulf War introduced an example of “unplanned trial” giving the opportunity to evaluate what happens with teleconferences when the number of international flight travels from Norway dropped by 25 per cent.¹³

The hybrid community as a quasi-experiment represents more deliberate trials, and in this book I have chosen a multiple-case study design as a method to analyse the different roles that hybrid communities are given. The concept hybrid community is used to denote that humans, non-humans and the textual expressions partake in the hybridisation process. To understand the hybridisation process I have joined them partly as a participant observer. This participation demanded some skills in the use of new communication technologies as it is an important part of the hybrid community and not least

the language of the social actors. The design and methods of this study are described in the last part of chapter 1.

Hybrid communities, which attempt to construct communication systems and applications in real settings, and to establish how far they achieve the expected goals and what unexpected issues arise, have been introduced for different reasons. Hybrid communities usually play four different roles¹⁴ according to the diffusion of innovation model and each of the case studies presented will be used to discuss one of these roles more explicitly:

1) They can be *explorative experiments*. Their most important benefits derive from the acquisition of knowledge. They help the researchers to define problems, or more useful ways of coping with the problem of “needs”, exploring different possibilities for interventions and, finally, showing how experiments at a later stage should be operated. The most characteristic feature of explorative experiments is therefore their usefulness at a very early stage of learning: when we know the least about all the possible implications and by experimentation enhance our knowledge and thereby lower the risk of innovating.

2) They can be *pilot experiments*, raising public and industrial awareness, stimulating debate and open policy-making. As such, pilot experiments can perform important functions¹⁵: they can test the applicability of innovations in places with conditions similar to those under which the more explorative experiments were performed; they can test the feasibility and acceptability of innovations in new environments; and they can extend an innovation’s range of proven feasibility beyond the experimental stage.

3) They can be important *demonstration experiments* in the dissemination and diffusion of the uses and implications of information and communication technologies. The main purpose of demonstration experiments is to show potential adopters how they may benefit from the innovations. Thus, although demonstration projects may evolve from explorative experiments and pilot projects they might also be designed especially to promote the adoption of a specific innovation.

4) They can be typical *replication or dissemination experiments* to disseminate tested methods, techniques or models through replication, full-scale implementation of a specific technological system.

In the world of telecommunity, our participatory possibilities are decided by how we are linked to the world's biggest machine, the telecommunication system. For a large number of actors, especially in the developing countries, these links are simply missing, and along the rural-urban continuum in both the industrial and developing countries the differences are growing, giving priority to the economic strongholds of the world economy. However, both the telecommunication companies and policy authorities have used large resources on hybrid communities in rural areas testing out the use of new telecommunication technology and new teleservices primarily for the promotion of more or better jobs, rural or industrial development, more or better services and an enhancement of political good-will (and of course increased revenue).

In spite of the resources used, the results have been a disappointment for many of the actors involved on both the user and the producer side. These hybrid communities have therefore very often been perceived as "failures" by one or several of the actor-groups involved. The technology that was tested did not satisfy the users' expectations, the services were not meeting an expected demand and the marketplace was difficult to identify. In the hindsight of evaluation the reasons for this disappointment are explained; but the evaluators claim that in spite of the disappointments one may find some "gold" in the sandbox of the hybrid community.

The retrospective story therefore includes the importance of negative feedback, but even more important, the policy authorities, the experimenters, and the local participants have learned during the process of experimentation. What they have learned is however not specified very explicitly, and the problems of "negative learning" are seldom discussed.¹⁶ After the expenditure of millions and even billions of whatever currency this cold comfort may seem meagre, and the learning process may be perceived as extremely expensive.

This process of reframing the interpretation of tests is also discussed by Pinch, Ashmore and Mulkay, who distinguish between the strong and the weak programme in their analysis of what they call "social technologies" or in their terms clinical budgeting. They identify

"two broad forms of rhetoric: a strong-program rhetoric that draws on economic principle and carries the promise of radical change - change that can be tested and evaluated in an independent and scientific manner; and a

weak-program rhetoric that is sensitive to the complex social and political realities of organizational change, presents clinical budgeting in a mild unthreatening way, views research on clinical budgeting as a slow learning process, and recognizes that technologies are evaluated in a practical and political context".¹⁷

However, the reframing of tests touches on something important: *learning is an important part of hybrid communities*. It may seem both unnecessary and tautological to stress this point. However, as I will illustrate later, the opportunities to profit from the learning process are often misused or neglected in hybrid communities.

What is usually the problem with many hybrid communities is therefore not necessarily the failure of a specific technological design or solution, but rather that the focus shifts from the learning process to a more blurred vision of new inventions and a superficial application of the diffusion of innovation-perspective. This is a problem for 1) *researchers as they do not learn how the framing of research limits the possibilities for efficient policy measures*, and 2) *for the local participants since the only lesson they derive from the project is not to participate in this kind of project again*.

The Model of Diffusion versus the Model of Translation

Two classical models of the diffusion of innovations, the "technology-push" model and the "demand-pull" model, are both basically linear models. The technology-push model emphasizes the important role of scientific and technological progress and, according to this model, discovery in basic science leads eventually to industrial technological development that finally results in a flow of new products and processes to the market place.

The demand-pull or sometimes called the need-pull model emphasizes the role of felt needs in innovation. Innovations arise as the result of a perceived and often articulated market need. As both these models later on were considered over-simplified, several more interactive models have been launched. My intention is not to review all these attempts but more modestly

to focus on one meeting place between the users and the producers, namely hybrid communities with new telecommunication technology.

Instead of using the diffusion of innovation perspective with a strong focus on the adoption process I will describe the innovation process in hybrid communities as a number of translations outlining different strategies and dynamics involved in each of these translations and: "I will call translation the interpretation given by the fact-builders of their interests and that of the people they enrol".¹⁸ In the translation model of technological innovation, the innovation is a temporary interpretation of nature, of technological potentials, of the strategies of competitors in the markets and the different interests.¹⁹ While the diffusion of innovation model focuses on the *transmission* of the same artifact, the translation model reveals a continuous *transformation* of the artifact.

The translations involve different user-producer groups at different stages of the process. In the first stage, according to Latour, engineers, inventors, manufacturers or designers "inscribe" in the artifacts certain user-values depending on their planned achievements and their perception of the user-groups available. When these artifacts meet the inscribed user-group they undergo a sequence of translations depending on the user-group's perception of possible use. However, these inscribed user-groups seldom encompass all social groups, and when the technology is more mature in the market new user-groups are enrolled in the inscription of the artifact and different reinterpretations of the user-values take place.

This does not, however, imply that user-groups not inscribed in the artifact from the beginning, do not partake in the translation of the artifact long before they are enrolled by the producers. An example of the translation of "user-values", performed more or less as a joke with the user-value of prestige, are the toy-like imitation cellular telephones. The first group of inscribed users were mostly business-men and the like, but with the help of imitation cellular telephones everybody can now afford to communicate the more symbolic user-values of the cellular telephones if they like.

The strength of the translation model is that it can encompass still undecided controversies, while the diffusion of innovation model refers to established facts and machines. One serious shortcoming of the diffusion of innovation model is the pro-innovation bias. To avoid such a bias Rogers

proposes five research strategies²⁰; 1) try to explore alternatives to post hoc studies, 2) also study unsuccessful innovations, 3) acknowledge that rejection, discontinuance and re-invention may also be rational and appropriate from the individual's point of view, 4) include how the broader context as initial decisions and policies affects the rate of diffusion, and finally 5) increase our understanding of the motivations for adopting innovations.

In spite of the fact that it is important to avoid a pro-innovation bias, he clearly demonstrates that this is an important tradition in innovation studies. One reason for this bias is found in the very strong focus on the adopter, while the invention process including the reinvention and reinterpretation by users plays a more modest role. Another reason is reflected in the vocabulary of the diffusion of innovation model, heavily affected by perceptions that the behaviour of people is caused by the diffusion of facts and machines.²¹

Given this, the translation model offer methods and concepts to open up the innovation process not post hoc, but as the process occurs.²² Since the translation model is process oriented it has no bias towards successful innovations, and several of the innovations studied have been studies of failures. The model puts the actor or actant in the centre, taking care of both the adopters' roles as actors and their participation in the invention process. Policy and context are important for the understanding of the translation process and not least for the understanding of how invention as a process involves actors, facts and machines. The strategies for building both facts and artifacts through the creation of actor-networks also encompass both actors' intentions and of course unintended consequences.

Furthermore, Callon, Latour and later Ackrich propose concepts borrowed from semiotics.²³ These concepts have the advantage that they have no pro-innovation bias and open up for a better understanding of the processes as such.

As a general model, the translation model is well adapted to the study of hybrid communities and laboratory studies. Some critics have also claimed that this is a limitation of the model and that this model is less adapted to more general science and technology studies.²⁴ The implications of this critique will be discussed later. However, as a recent model in science and technology studies, it still needs to be explored and extended.

My aim in this respect is, by means of some case studies of hybrid communities and technology testing, to develop an important part of the model, i.e. *how actors frame the context of hybrid communities and thereby also the interpretation of the same experiments*. This will enable a more active inclusion of cognitive factors, as it seems that Latour prefers to speak of cognitive factors only if there is something unexplained when the networks have been studied.²⁵ I think this is a weakness of the model, and the cognitive factors will be included in my approach by the concept of frame, which I will return to in the next section.

In the following I will therefore analyse the problem of testing by focusing on the process of framing. My strategy for attempting to realise this approach is the exploration of a metaphor: the machines as “text” in a shifting context. The idea is to begin with the hypothesis that the capacity of the machine is, at least in principle, interpretively flexible. This then sets the frame for an examination of the processes of construction (writing) and the use (reading) of the machine; the relation between readers and writers is understood as mediated by the machine and by the interpretations of what the machine is, what it’s for, what can it do.²⁶

Frame Analysis

A very common statement in many policy relevant settings some few years ago, was that: “only human fantasy limits technological possibilities”. This statement implied that if we had a more creative fantasy, we would also enlarge the technological possibilities. This image of our fantasy is self-evident, and not very interesting in our analysis. More important is the fact that our fantasies or images also limit our possibility to rephrase the problems and to predict possible solutions. Our fantasy is therefore a puzzle. Not only is our creativity a limit in itself, but our actual perception of the problems steers our imagination and thereby creates boundaries around it. Our perception may therefore be restricted and in this connection frames²⁷ can refer metaphorically both to the “closure” of a situation as well as its inner structure.

“It evokes the fact that the subject apprehends the situation as a whole, as an opposition between an inside - which is formed by the subject attending

the situation - and an outside which is a mere outer limit, a sort of fencing off of irrelevance, but it is also a trap: in the slang of criminals, framing someone means to superimpose a situation upon another situation which loses its autonomy and becomes contaminated, so to speak, by the engineered or fabricated situation; in other words situation A is framed by situation B and becomes ambiguous as it is congruent with both frames, with the difference that situation B is usually more pregnant (or more deviant) than situation A and entails a legal sanction."²⁸

In his book "Frame Analysis"²⁹ Goffman refers to Bateson and his use of the term frame. Actors do not act in a vacuum, they act in a context. Frames are therefore the context one applies to organise involvement as well as meaning: any frame imparts not only "a sense of what is going on" but also "expectations of a normative kind as to how deeply and fully the individual is to be carried into the activity organised by the frame" (p. 345). The frame represents clusters of rules that help to constitute and regulate activities, defining them as activities of a certain sort and as subject to a given range of sanctions. Perception is organised, he claims, into natural and social frameworks. The natural frameworks identify occurrences seen as undirected, inanimate, unguided. The social frameworks provide a background for the understanding of events that incorporate the will, aim, and controlling effort of an intelligence, a live agency, the chief one being the human being.³⁰ Goffman therefore includes both the inanimate and the animate, the natural and the social in the creation of frames.

In their study of laboratory life, Latour and Woolgar discuss the different analytical positions of the researchers and other actors "participating" in an analytical scheme.³¹ What an act means is never self-evident and two persons may interpret the same event in completely different ways. In trying to have a holistic view of human behaviour, anthropologists analyse the various aspects of a culture as a dynamic set of processes in order to avoid a static ethnographic description. The application of such a perspective helps to analyse communication acts as processes. The schema that favours the deductive production of independently testable descriptions is oriented towards what has been called *etic* validation i.e. the categories of the researcher, the "objective" categories.³²

By contrast, the schema that favours the “emergence” of phenomenologically informed descriptions of social behaviour is most appropriate to *emic* validation: that is, the ultimate decision about the adequacy of descriptions rests with the participants themselves. This has the advantage that descriptions produced by an observer are less likely to be mere impositions of categories and concepts that are alien to participants. As such, “etic” refers to a universal category, while “emic” is culture specific.³³ Since frames are the context one applies to organise involvement as well as meaning, frames are consequently *emic* categories.³⁴

This is a very crude distinction between methods for making sense of empirical observations. If one as an observer is reliant on an *emic* approach, one will necessarily be concerned with whether or not one is using the concepts employed by the subject of the study correctly. If this is a very strong leitmotiv then the danger of going “native” will always be there: by this process our analysis can be both incomprehensible and unhelpful to people not belonging to the “community”. However, individuals in all forms of societies are able to distance themselves from the rules that regulate behaviour and it is therefore important to take seriously the concepts used by the members of the hybrid communities, the researchers included, in an attempt to explain participants’ use of different concepts as a social phenomenon. Both the role of research and the participation of different actors will then be important elements in the study of testing.

A frame thereby provides the rules and principles that guide our understanding of meaning in experienced events. Framing as constitutive of, and constricted by, encounters therefore “makes sense” of the activities in which participants engage, both for themselves and for others. The framing of a test setting implies a selection of some aspects of a perceived situation to make them more salient in a test, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or policy measures for the problem described and thereby also organise involvement in the inscription-translation-reinterpretation of technology. As discussed by Entmann, frames therefore define problems, diagnose causes, make moral judgements and suggest remedies.³⁵

In this connection it is also important to remember that frames constitute a message on a more metacommunicative level. It is of course possible to

change the rules in more experimental actions, "but every such experimental action, in which a proposal to change the rules is implicit, is itself a part of the ongoing game".³⁶ Latour suggests the vocabulary of semiotics to analyse the development of processes, since semiotics is the study of order building or path building and may be applied to settings, machines, bodies, as well as text.³⁷ Among the concepts which I find particular useful I will elaborate on the concepts of shifting out and shifting in. By these two concepts Latour refers to the displacement to another frame of reference that allows an actant to leave the original frame and enter an other in order to transmit a message or to gain insight. By these techniques we impose meaning upon our actions.

Frames organise more than the test settings and the interpretation, they also organise involvement. During the activity, participants will not only obtain a sense of what is going on but will also be engrossed, caught up, enthralled or disappointed. These feelings and experiences will be transmitted to other actors. However, "involvement is an interlocking obligation. Should one participant fail to maintain prescribed attention, other participants are likely to become alive to this fact and perforce involved in considering what the delict means and what should be done about they themselves should be involved in."³⁸

The framing of research questions in hybrid communities is therefore important for how we try to solve the problems. As frames are both inclusive and exclusive I will pay special attention to the use of frames and how we manipulate the interrelationship between frames. When it comes to the framing of test settings we may experience multiple sets of frames during the process. However, *to facilitate and simplify the discussion I will concentrate on the problem of double framing - be it either conflicting, competing, incompatible or compatible framing.*

The Research Agenda

Hybrid communities are given four different roles in the diffusion of innovation model. My claim is that these four "roles" do not enable us to understand the innovation-process as an ongoing process of inscription-translation-reinterpretation. The diffusion of innovation model has strongly

influenced how the initiators frame hybrid communities. I have therefore arranged the chosen case studies³⁹ according to how the initiators perceived them as meeting places between users and producers at different stages of the diffusion process. By this arrangement I will also promote a discussion of the advantage of the translation model compared to the diffusion of innovation model.

Graphically, the results of a successful innovation process in the diffusion of innovation model are presented as an s-shaped diffusion curve, and the adopter categories encompass the innovators, the early adopters, the early majority, the late majority and finally the laggards. The crucial issue for anyone who wishes to promote an innovation, is, according to this theory, to activate the early adopters and early majority. The s-shaped diffusion curve illustrates this by “taking off” at about 10 to 25 per cent adoption. However, the hybrid communities here described are situated along the whole spectrum of the s-shaped curve. As the s-shaped diffusion curve also illustrates the increase of knowledge about an innovation, the chosen hybrid communities apparently embody a decreasing uncertainty. See figure 1.

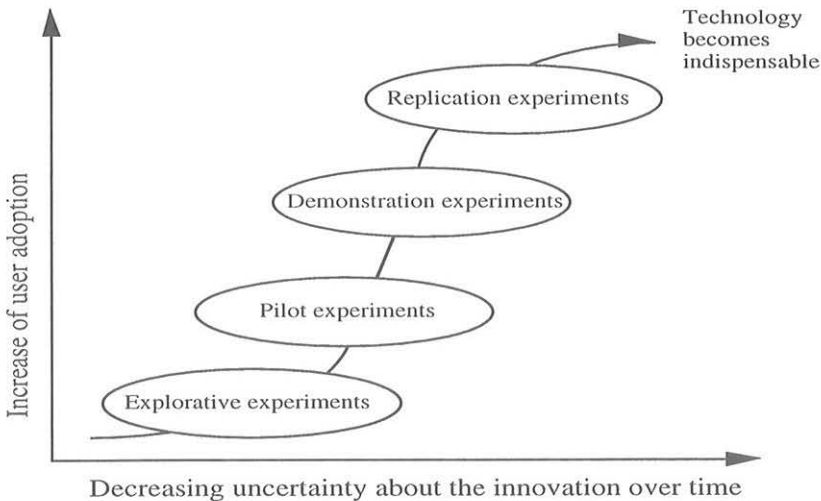


Figure 1 The arrangement of the case studies.

The four case studies are the R&D driven experiment, the local development driven experiment, the industrial development driven experiment and the user-value driven experiment.

The R&D Driven Experiment -> The Explorative Experiment

I would like to begin with the case study of testing a more or less undefined range of technological possibilities. This kind of hybrid community represents an explorative experiment in which the aim is to enlarge knowledge about technology in a user-producer situation. The case study chosen is a pioneering test by Norwegian Telecom or Telenor, testing out a variety of possibilities in the municipality of Jevnaker, also called the *Telematic Sandbox*. An extended field experiment was planned in 1982, and started in 1984. It is not possible to present all aspects of this case study and I will therefore concentrate on some of the services aimed at local industry.⁴⁰

The Local Development Driven Experiment -> The Pilot Experiment

The second hybrid community represents the testing of a more limited range of technological possibilities for the promotion of local development: without, however, aiming at a very specific target group. Four municipalities were selected for the test of a specific outcome of the Jevnaker project, the idea of telematic centres, but this time in a more "real" market context. From Jevnaker the "telematic centre" was inscribed with certain user-values and these user-values were translated into different settings in the pilot experiments. The experimentation with telematic centres, or as they later were called "*telecottages*", was partly implemented as a result of the Green Paper presented by the Tele Commission in 1983.⁴¹

The Industrial Development Driven Experiment -> The Demonstration Experiment

The next step on the ladder is the testing of a rather specific technological solution, aimed at a very specific target group. This case study derived from a large policy experiment, a R&D-program for regional development in Norway. From 1988/89 14 centres of expertise in information technology (also called FUNN centres) were established.⁴² FUNN was a co-operative program run by the following institutions: The Ministry of Industry, The Ministry of Local Government, the Regional Development Fund, Telenor, the Norwegian Council for Scientific and Industrial Research and the computer manufacturing firm Norsk Data. One specific solution in FUNN was the development and implementation of an information system for tourists and travellers, called AURORA.

The aims and assumptions underlying this experiment are presented in the Blegen report.⁴³

The User-Value Driven Experiment -> The Replication Experiment

The last case study chosen is an example of the testing of user needs. In this case study, the focus is on the interface between a specific range of technological solutions and needs as perceived by different user and producer groups. I have chosen to focus on a case study from Bénin.

Not only the industrialised countries, but also the developing countries wanted to participate in the technology driven race towards the future. In 1984 the Maitland Commission on behalf of the International Telecommunication Union submitted a policy paper called "The Missing Link".⁴⁴ The title indicates the fact that most developing countries lacked the necessary infrastructure for communication. The case study from Bénin does not therefore imply a wide range of sophisticated solutions, but rather well known technology. But, from the user point of view in Bénin, this technology is both advanced and unknown. *By this case study I think it will be possible to illustrate both the problems with the testing of user needs and how even "well known" technology can entail unknown aspects in a user perspective.*

Hybrid Communities and Policy

Taken together, the four case studies represent a sharpening of the focus (in the diffusion of innovation model). The first case studies limited problems that are elaborated more fully in the later case studies. In the translation model, Michel Callon describes how engineers become sociologists through their development of hypotheses about what other people want and need.⁴⁵ A large part of the work of innovators is as a result that of inscribing user-values in the technical content of new objects and then to enrol other actors in the support of these inscriptions. These inscriptions do not, however, only apply to the artifacts as such, but also to the whole experimental set-up. The more overall aim of this book is therefore to analyse the inscriptions by policy authorities, project makers and researchers into the hybrid community or, as it is often called, the “social laboratory”.

An important claim in the history of science⁴⁶ is that the reproduction of laboratory results, outside the context of the laboratory, can only occur under exactly the same circumstances that allowed for the possibility of the original results. Unless one is prepared to accept the fact that knowledge produced under specific laboratory conditions remains “only theoretical” knowledge, the transfer of laboratory observations (and results) into other contexts is possible only on the basis of a transfer or a re-creation of the conditions that produced the original results.

This “fact” may, however, be challenged by the fact that in “the case of technology, when building an artifact or setting up a technical system of some complexity, theoretical knowledge is almost never sufficient to make things work”.⁴⁷ Since tacit knowledge and *fingerspitzengefühl* are an important part of the re-creation of technology it may even be necessary to re-translate the original problems and solutions to be able to solve them “once more”.

However, tests do not simply report on pre-existing facts but, more important, they are also mechanisms for defining and producing the traits and capacities that they supposedly measure. What is conceivable also is that the (experimental) knowledge is modified and converted in ways that allow its adaptation to local, external circumstances. What determine the transfer and re-creation of experimental circumstances are, in most instances, however, economic and political interests.

Hybrid communities have mostly been established by actors working within a more overall technology-push strategy. Despite the increasing acceptance of more interactive models of innovation, it nevertheless remains clear that many policy authorities and companies continue to ascribe, at least implicitly, to more simplified models. In the recent period of extraordinary growth of new telecommunication technology and services, many countries and companies have applied a technology-push model. This preference for technology-push strategies also entails a strong emphasis on hybrid communities.⁴⁸

But more recently, it seems that several telecompanies are abandoning the technology-push strategy for a stronger emphasis on a demand-pull strategy for new technology and services. This is also becoming a general technology policy philosophy, advocated among others by ideas such as those of von Hippel that emphasize the importance of "lead users" or "advanced users" in the development of new products and services.⁴⁹ In Europe, British Telecom is perceived as a leading actor in this regard, inspiring both Telenor and other companies. These changes in strategies have also led to a reorientation of the use of hybrid communities, adapting more to an exploration of "needs" in the "market places" that are likely to demonstrate a profitable demand. By this they also abandon the less profitable rural areas to the very basic services of the telecompanies, as it is already happening in several industrial countries.⁵⁰

My claim will therefore be that the linkage between the "social laboratory" and "social reality" reflects the use of different policy strategies in the shaping of telecommunication technology. In strategies that, from the producers point of view, may be delineated as "technology-push", the strategy entails the creation of a new reality in the laboratory and the export of the experience derived from the experimentation back into the social reality. In strategies that, from the producers point of view, may be delineated as "demand-pull", the strategy implies the import of a partial social reality into the laboratory and, through the experiments, the reality is slightly changed and the experience is exported back into social reality.

The two strategies of technology-push and demand-pull are therefore not two opposing strategies, but counterparts in a more overall strategy emphasizing the importance of laboratory experience. This interaction is well summarised by apparently contradictory statements by two prominent

individuals.⁵¹ While Thomas Edison, the famous American inventor, wrote: "First be sure a thing is wanted or needed, then go ahead", the CEO of Sony corporation Akio Morita, a highly consumer-market oriented company, states: "Markets must be created, not surveyed", with Sony's advertising slogan: "Research Makes The Difference". By the growing emphasis on the markets the producers are more concerned about the users as such, and the producer's perception of the users will therefore guide the research and development activity. *I will therefore expect that the importance given to laboratory experience will shift from more open ended "field experiments" to what one may call "usability trials"*.⁵²

In the translation model, the negotiations take place between interests defined on the one hand in the sociogram ('outside' recruitment of interests), and on the other hand in the technogram ('inside' recruitment of new allies). The more open ended "field experiments" usually end up by testing the interface between the users of a specific solution and the sociogram, while the "usability trials" concentrate on testing the interface between the users of a specific solution and the technogram. In this process a paradox appears: *in technology-push strategies the technology plays the more modest role, while in demand-pull strategies the technology plays the more active role.*

The Shaping of a Method

In the following I will outline the method used to create an understanding of hybrid communities. The most active tradition of innovation is through hybridisation⁵³, combining resources from different economic spheres, skills or ideas. My research project is based upon the assumption that a technical artifact can be described in terms of a scenario: setting out a stage, roles and directions governing the interaction between the actors (human and others) who are supposed to assume these roles. From this stand-point, a decision made during the development stage implies a sharing of competencies between the artifact proper, its user and a body of social and technical elements constituting their common environment.⁵⁴

To study this process I have, together with colleagues or alone, conducted fieldwork that included participation in the hybrid communities, the study

of hybridisation processes, interviews with participants, project-makers, initiators and policy-makers, the production of written texts by the same groups, interviews with potential users of the services produced, the mobilisation of written text and pictures to enrol allies and of course the "behaviour" of the technology as such. A more detailed account of the empirical fieldwork is given in appendix 1. Only the case study of AURORA was made specifically for this book, the remaining three are taken from my research activities in technology assessment during the last ten years.

The study of communities, fieldwork, both in Norway and Bénin, necessitates a brief exegesis on the subject of anthropology. It is important to situate anthropology as the study of foreign cultures as well as our own. However, in doing so we must focus on the core elements of our own culture, not only the marginal aspects. The main advantage of anthropology is that the

"anthropologist *does not know* the nature of the society under study, nor where to draw the boundaries between the realms of technical, social, scientific, natural and so on. This additional freedom in defining the nature of the laboratory counts for much more than the artificial distance which one takes with the observed. This kind of anthropological approach can be used on any occasion when the composition of the society under study is uncertain. It is not necessary to travel to foreign countries to obtain this effect, even though this is the only way that many anthropologists have been able to achieve "distance". Indeed, this approach may very well be compatible with a close collaboration with the scientists and engineers under study. We retain from "ethnography" the working principle of *uncertainty* rather than the notion of exoticism." ⁵⁵

With this long quote I will recast the roles and look upon the hybrid community as a laboratory in which the participants are acting as researchers trying to cope with different technological possibilities and hindrances as the technology is their object of research, trial and error.

Only a few researchers use the test situation to develop a more *comparative method*. In most of the comparative projects, however, the researchers are either a) comparing different technological solutions within the same group of users or b) comparing one technological solution as between different groups of users and non-users. An outstanding example of the first type of comparative

projects is the telemedicine research of Conrath, Dunn and Higgins. They designed a four-stage program: observation, laboratory experiments, field trial, followed by the implementation of a regular service. The doctor's ability to determine the diagnoses were tested in a comparative setting, comparing the modes of a) physical presence, b) colour television, c) black-and-white television and d) "hands-free" telephone. Only when physical-presence consultation was compared to the three modes of telecommunication - and only for secondary medical problems - was there a statistical, significant superiority of a sensory-rich mode.⁵⁶ The conclusion to be drawn is that counterintuitive results could be expected when communication technologies are compared, and that the sound-only medium might be surprisingly effective. To improve the understanding of hybrid communities and their use in technology R&D and technology policy I have applied a comparative approach to explore their different "roles" in the diffusion of innovation model.

As an applied part of social science, "social experiments" with new communication technology or telecommunications have several aspects;

"Highly mixed motives and intentions may lie behind the start of such projects. The concrete Norwegian examples may also have shown that the results may be as numerous. And much of the motivation and the result lie outside the research sphere, or in the border zone between research and other practices. Marketing, education and research: this typology can put a name to some of the different sides of the social experiment activity".⁵⁷

"Social experiments" have in many cases a marketing effect, and they function as demonstrations of possibilities that are often hard to understand. The fact that the unknown becomes concretised, illustrates that marketing also contains some education. Through the experiments, the participants learn something about the possibilities for the future. As research, the use of hybrid communities entails that anthropology is pulled into the development and application of new technology. Therefore the research does not primarily consist of evaluating social consequences, but of elucidating the interplay between concrete technological solutions and social systems. The objective is to arrive at technological solutions and thereby satisfy certain social needs in the best possible manner. In this connection a usual objection is that we start with the solution before we know the question.

According to the critics, one should preferably ascertain the needs and then develop the actual solutions. The relation between needs and solutions is, however, not that easy to determine. The Danish research community doing studies on hybrid communities in the 1980s designed a research approach called "dialogue" research. By dialogue research is understood research that is financially independent of the experiment and not responsible for its implementation. This type of research engages in a close dialogue with the experiment, supplies data and current ideas, and participates in the dialogue.⁵⁸

Technology testing has revealed some of the potentials of new communication systems but has also illustrated that users tend to prefer the medium that experimenters suggest would be most effective for the purpose in question. We therefore experience that testing technology is an important part of the shaping of technology, making our images into reality. Rosenthal has called this the "experimenter expectancy effect".⁵⁹ This means that the results of experiments tend to come out in a way that favours the experimenter's expectation of how they ought to come out however much he or she tries to avoid bias. A similar problem is found among the participants when they respond to the experiment. This was found by a group of researchers when they studied the relationship between production and lighting intensity at Western Electric Company. Among other activities conducted they also tested the relationship between worker output and worker conditions. They found no relationship, but they did notice one interesting phenomenon. Even if workers' conditions worsened, worker production increased. This effect is later called the Hawthorne effect, after the Hawthorne plant of Western Electric.

The experimenter's expectation bias also influences the explanation of failures. One way, which is that usually taken by scientists who have come up with negative results, is to say that negative results illustrate that it is necessary to change how we framed the test, not necessarily what we tested. Failures, therefore, do not necessarily tell us anything about the technology, but primarily something about the test. When one discusses the long range of hybrid communities it is important to have this in mind. By technology testing the experimenters strive to make the technology comply with their expectations embedded in the tests as to how the technology should perform and should

not perform. When the technology does not perform according to their expectations they often look for external reasons for failures, not explaining the problematic construction of their own images.

All tests contain the condition of intent: they are planned, arranged, given, or conducted by someone with some purpose in mind.⁶⁰ Since intention is a crucial element, ethical and political considerations have to be a central part of hybrid communities. Melody claims that, in order to understand adequately the potential impact of telecommunication networks, we must try to compare the new communication systems with the old ones.⁶¹ What Melody finds important - and totally overlooked in the great majority of studies - is an examination of the information and communication networks being used prior to the introduction of new technologies. Without knowing the prior information flows and communication relations, one has no base with which to compare the new, changed relations resulting from the implementation of new technologies.

The failure to pay adequate attention to the base condition often results in a simple documentation of purported benefits of the new technology to those particular users who have benefited. This approach tends to draw the researcher into the role as myopic or short-sighted promoter of the technology. However, Melody does not present a clear cut answer to solving this before and after question and to a certain degree the idea of a baseline is closely connected to the idea of the "laboratory", the laboratory with four walls and well-limited borders. I find the idea of a baseline problematic and will pursue other research strategies to see if it is possible to understand the processes without being a "myopic promoter of the technology".

Outline of the Argument

Linked to the concept of the social laboratory I will, in chapter three, elaborate on some theoretical perspectives that will help understand hybrid communities. One important perspective is linked to the symmetry argument. Following Bloor, Callon extended the symmetry principle, and stated that the social, the technical, and the objects in the natural world as a rule of method should be analysed in the same terms. The descriptive model aimed at will therefore

ascribe to this principle of symmetry and furthermore apply a framework that allow us to make case studies which grasp the complexity of technical development, while still allowing for an inter-case comparison. Such a comparative approach will enable us to make generalisations on the basis of several case studies, and to work towards a more general theory of technology testing.

In the chapter thereafter, I present the development of telecommunication services more generally and their relevance for rural development. The second part of the chapter is devoted to how different user-producer viewpoints are manifested in policy documents. The policy viewpoints were translated into different suggestions for testing the application of new telecommunication services. The leading question in chapter four is how to understand the role of policy formulations in technology development and testing. An important conceptual issue in chapter four is to give a background for a closer study of the symmetry argument. Bloor established the principle of symmetry; the stipulation that true and false beliefs should be analysed in the same terms. In policy arguments one solution is often selected, while other solutions are rejected. However, in policy studies it is important to study both the selected and the rejected policy alternatives.

In the next four chapters (5,6,7 and 8) the empirical studies are presented. The approach has been to present four case studies. The case studies are arranged in a staircase fashion, starting in the world of producers and moving towards the world of the users or consumers.⁶² Each case has its own strength in relation to the more analytical elaboration. However, all the case studies are used to discuss the main questions of this book. On each step, different elements will be introduced to describe the actual case and the same elements will be carried over for the use on later steps. Beside the fact that each case is introduced to elaborate on a growing number of relevant elements of technology testing, each step also has its own story to tell. Thus I have introduced some empirical and analytical elements more specific to the study of telecommunications as such, as well as the methodological discussions which link this framework to the more theoretical debate in technology studies.

In the last chapter I will first confront my questions with the described case studies and finally explore the activity of telecommunication testing. The chapter takes as its starting point the problem of framing tests and how

different framing of tests relate to each other and to the final outcome of the test. In the first part of chapter I will therefore discuss the problems linked to framing. However, not only are the tests framed, but also the different actors participating in tests. The recruitment of actors and their anticipated and/or chosen roles are crucial for the outcome of the tests. I will also discuss the relationship between the framing of tests, and the dialogue between problems and solutions.

In the next part of chapter nine I will use the previous discussion to develop a framework for technology testing and discuss how hybrid communities find their resolution and “closure”. Finally, I will summarise the use of the translation model compared to the diffusion of innovation model.

However, before I set out on this journey into the life of hybrid communities, I will make a small reconnaissance into Terra Nova.

2. Following the Actors and the Controversies in a Hybrid Community

The Idea of the Countermeasurement

To facilitate this journey into the life of hybrid communities I will start with one of the Norwegian field trials with telework in the 1980s. The life of hybrid communities may be understood as expeditions in unknown territories hosting controversies shaped by a complex setting. To grasp the complexity of such ventures I will make a detour to a parallel from the history of Polar exploration; The race for the South Pole between Amundsen and Scott. Two expeditions set out to be first on the South Pole, the expeditions of Amundsen and Scott. As expeditions in a totally unknown environment they were both hybrid communities on the brink of human capability. Their choice of technology and strategies were strikingly different and the success of the one expedition and the failure of the other are later explained and reinterpreted many times.⁶³ Amundsen enrolled polar dogs from Greenland, clothes and food from the Netsilik Eskimos, cloud berries and blueberries against scurvy, the art of skiing from Telemark, modern navigation methods from England and much experience from the Arctic. Scott enrolled modern motor sledges (some of the very first one produced) for transport as well as horses from Mongolia and a few dogs from Siberia (and the "heroic" act of man-hauling the sledges), but also military traditions and scientists from the British Empire, and even the first telephone-line in the Antarctic for his hopefully success. The result was a triumph for Amundsen and a disaster for Scott. Amundsen got to the pole first and Scott and his four companions all died of hunger and scurvy, cold and exposure.

However, if my intention with this detour was to promote that well-known technology represents a safer path to success than technology in the making, this would have been a rather one-dimensional introduction to a multidimensional problem. First of all, Amundsen was not at all an enemy of technology in the making. He was later to approach the North Pole by

aeroplane and was the first to cross the Arctic in an airship. One can find other important differences between Scott and Amundsen than just their choice of technology. The most important differences are found in their overall choice of strategy and how they perceived and tackled the problem of risk. Amundsen was a very careful man, and planned everything, even the very smallest details. However, he took two large risks. First he went to the South Pole when all his financial and moral supporters thought he was bound for the North Pole. Second he went into completely new territory, there was no prior knowledge of the route he was bound for. At the opposite extreme, Scott had full support for his South Pole expedition and he walked for most of the distance in the footsteps of Shackleton. However, the large number of small risks he took aggregated into a fatal conclusion.

The technology I will follow on this first reconnaissance is the technology of telework. One would not normally think of telework as a technology. However, telework incorporates material artifacts such as computers, software and not the least, the telecommunication system. The shaping of different models for the implementation of telework may therefore be conceptualised as a "social technology". Telework represents a less dramatic venture into Terra Nova than the expeditions of Amundsen and Scott. However, our perceptions of this unknown territory frame our thinking and choice of strategies while we try to explore the possibilities.

To follow the actors I will start with some of the ideas behind one of the models for telework - the social invention called telematic centres or telecottages. In the beginning of the 1980s many futuristic writers wrote scenarios that tried to prescribe the "fifth Information and Communication Kondratieff". One of these writers was Alvin Toffler, who in 1980 outlined the world of telecommunity in which the electronic cottage might be "characteristic mom-and-pop business of the future".⁶⁴

Translated into a Norwegian and Nordic context this future was not perceived as bright as Toffler's. One reason for this is to be found in developments on the labour market. After many years, women had gained more or less equal opportunities in education and work, and jobs located at home were perceived as a threat to their hard gained rights and therefore undesirable. However, on a policy level it was important to explore the possibilities for rural development that might be found in new information

and communication technology. Since homework was perceived as a solution that would gain a foothold anyhow, and in fact not a very desirable solution, the idea of the countermeasurement was born.

The Shaping of Social Technologies as Countermeasurements

Since the “characteristic mom-and-pop business of the future” was not perceived as desirable, other solutions had to be explored. A likely countermeasurement was to stimulate the establishment of telematic centres, i.e. centres where people could work for different employers; but without losing the community spirit of a workplace. To understand the fate of the telematic centres or later the telecottages, one has therefore to explore the role they were given; to counter an undesirable development. Few contradicted this view and, in the policy-paper of 1983, one finds no suggestions to explore the “undesired solution” or homework. One does find, however, a suggestion to establish field trials with information- and communication technology. These field trials were to be organised as telematic centres.

To examine this development, I have chosen to follow some “communal entrepreneurs” and the controversies in the “social laboratory” established in Hamarøy. My starting point is the automation of the telephone exchange in Hamarøy and the actions the “communal entrepreneurs” took to counteract the loss of local jobs.

In local development work one often finds alliances between the actors, professional development officers, politicians and idealists affected. This alliance one also finds in Hamarøy and I have called this team the communal entrepreneurs. In Hamarøy the group consisted of the shop steward of the manual telephone exchange, the local development officer (who was later to become the chief officer of the municipality), the chairman of the municipal council (on leave from his job at Telenor), and the old mentor of Hamarøy, a civil engineer and retired general manager of a large industrial company. The mentor had also international experience from 10 years in the Middle-East, where he, among other activities, had been Norwegian consul-general. These

four persons constituted the core of the communal team. Other people did important jobs, but this core group tried to speak for the whole actor-network.

In this reconnaissance I will follow the translation approach of Michel Callon and Bruno Latour. Adapted from Callon⁶⁵, four 'moments' of translation are recognised in the attempts by these communal entrepreneurs to impose themselves and their definition of the situation on others: (a) problematisation: the communal entrepreneurs sought to be indispensable to other actors in the drama by defining the nature and the problems of the latter and then suggesting that these would be resolved if the actors negotiated the 'obligatory passage point' of the communal entrepreneurs' programme of exploration; (b) intersement: a series of processes by which the communal entrepreneurs sought to lock the other actants into the roles that had been proposed for them in that programme; (c) enrolment: a set of strategies in which the communal entrepreneurs sought to define and interrelate the various roles they had allocated to others; (d) mobilisation: a set of methods used by the communal entrepreneurs to ensure that supposed spokespersons for various relevant collectivities were able to represent those collectivities properly and not betrayed by the latter.

Countermeasurements as Problematisation

In many remote communities the manual telephone exchange was both the mediator between people and an important place where women found a "modern" job. When these manual telephone exchanges were replaced by automatic exchanges, many women lost their jobs and in Hamarøy 27 women were out of work in 1983.

At that time, the local development officer was responsible investigating new opportunities for the jobless women. Entrepreneurs are usually perceived as actors who, in order to maximise culturally valued assets, act strategically within limits set by factors outside their control. In local and rural development, the scarcity of local entrepreneurs has frequently been perceived as a problem. To stimulate local entrepreneurship and to facilitate entrepreneurial success many local communities have employed development officers. Their tasks have been to advocate, manage, referee, arbitrate or to judge projects and ideas or simply to transmit knowledge in some fashion to

promote potential entrepreneurs. However, the limited local "market" for entrepreneurial activities has often "forced" the development officers into different entrepreneurial roles.

At the beginning, the shop steward and the development officer tried to convince Telenor that they could relocate jobs from the cities to Hamarøy. The development officer states that "The response to this suggestion was zero even though Telenor at that time had a committee working with relocation of jobs; The relocation committee". The preliminary report from this committee was not given to the development officer. However, he became aware of the work of this committee through other channels.

In the next meeting with Telenor, the development officer confronted the local representative with the suggestions of the national committee, which the local representative had no knowledge of. By making a link between the national committee for relocation and the local problems in Hamarøy the development officer and the shop steward made it difficult for Telenor to be completely uncooperative. By this act the communal entrepreneurs had started to determine a set of actants and define their identities in such a way that the communal entrepreneurs established themselves as an obligatory passage point in the network of relationships they now had started to build. Hamarøy managed by this act to enrol financial support from Telenor for the procurement of necessary equipment and temporary economic support to Telenor's former employees.

In 1982/83 an alarm monitoring centre was established as a municipal project with a steering committee consisting of the council engineer, a representative from the health sector, a representative from the employees and the development officer. At that time, very few contested the idea that one could establish a small alarm monitoring centre in Hamarøy and produce services by the help of telecommunications that could be sold far from Hamarøy. One question needs to be asked: Why an alarm monitoring centre? Three reasons are important, which also illustrate other links in the growing network. First that the women from the old telephone exchange had very little formal education, their strength was their willingness to work at any time 24 hours around the clock. Second, the national authorities had plans to divide the nation in different alarm monitoring zones. Each zone should be operated by an alarm monitoring centre. If Hamarøy managed to be a

pioneer in this field, they could be selected as the centre, and thereby enrol permanent jobs paid by national authorities. Third, the Tele Commission had proposed the establishment of telematic centres as local field trials. If Hamarøy managed to combine the idea of an alarm monitoring centre with the idea of a telematic centre they had a second argument for the enrolment of support among national actors.

Very few answers were, however, given to the overall important problem at the time: Would anybody buy the services produced? Other questions accompanied the first one. How should the services be marketed? Would the buyers pay for the extra transaction costs? And the question of time. Would it be possible to succeed before the project period came to an end?

According to the written documents, the communal entrepreneurs displayed great confidence in the new idea and, just as Amundsen and Scott, they had to conceal all their doubts to convince the financial sources about the anticipated success. The communal entrepreneurs had made a double move; they had made a successful attempt to save local jobs and in this move they had circumscribed both the national plan for alarm monitoring zones and also the innovation from the Tele Commission; the idea of the telematic centre. This double movement rendered them indispensable, a process which Callon calls problematisation.

The Interdefinition of the Actants

The questions formed by the communal entrepreneurs brought three other actants directly into the story: the women from the manual telephone exchange, the national authorities, and the telecommunication technology. The definition of these actants explains how they were concerned with the different questions which were formulated:

1) The women from the local manual telephone exchange lost their jobs and were therefore the focus of attention. However, in the papers and accounts, they play a rather passive role and are usually only passively enrolled to support the project. For example, when enrolled for their competence in the project proposal; "This is people that are used to handle telephones". The resolution of the vital questions linked to marketing, transaction costs, etc. are however never linked to the "telephone exchange women".

2) The national actors produce policy and documents. Policy actions often entail actions by public authorities and/or in the public sector, and sometimes the establishment of new public institutions. It is an important aim for local development officers to exploit the possibilities that may be created in the public sector, since these activities are reasonable permanent and well paid compared to the private sector (at least in remote communities). Policy documents therefore represent valuable arguments when entrepreneurs try to enrol political and financial support.

3) The telecommunication technology entailed changes that would result in a decrease of employment in Telenor in certain activities, while it would result in an increase of employment in other activities. However, as the development officer state, "The decrease would occur in the remote regions, while the increase would occur in the larger cities". The paradox for the communal entrepreneurs was the fact that "the local community had no possibilities without modern telecommunications". By this definition the development of modern telecommunications were made important, but ambiguous. This ambiguity is one of the most important sources for controversies as the project develops. And by this problematisation the communal entrepreneurs achieved support, since the technological ambiguity also troubled national policy makers. The local project in Hamarøy was therefore no longer solely a project that should solve the problems made by the introduction of automatic exchanges in the telephone system. It was a "social laboratory" where national policy makers could explore the use of new information and communication technology for regional and rural development. The important question - can new information and communication technology be used to create new job opportunities in rural areas? - was enough to involve a whole series of actants by establishing their identities and the links between them.

After the establishment of the alarm monitoring centre, the development officer was looking for new opportunities and got a job as director of Jæren Development Council. While he was director of Jæren Development Council he promoted the idea that all kinds of public organisations and private enterprises should explore the use of telematics for their own benefit. Many projects were launched, and among these was a project about telework. This project had a direct link to his earlier ideas and activities in Hamarøy, and

since he in 1986 was head hunted to the job as the chief officer of the municipality of Hamarøy, he enrolled Hamarøy into the planned project.

The Definition of Obligatory Passage Points

When the development officer returned to Hamarøy, the alarm monitoring centre faced financial and organisational problems. Originally, the alarm monitoring centre was planned to make a profit after a couple of years when the subsidies from Telenor and different public agencies came to an end. However, when the development officer returned, the subsidies were soon to end without the alarm monitoring centre generating the necessary income in the market. The following services were produced; the monitoring of fire alarms, co-ordination of the local emergency ward and midwife service, security alarms for elderly people, life-saving service, telemetric control of temperature, pH-level, salinity etc. in fish-farming, different kinds of information services, a switchboard and secretary services for the municipal town hall, etc. The idea was that the alarm monitoring centre should generate income both from sales of services to private customers and to the local public administration. Nine people were employed at the centre.

It was not possible at that time to save the alarm monitoring centre without more public funding. The communal entrepreneurs designed a new project proposal and managed to enrol The Ministry of Local Government and thereby NOK 1.25 million for a project on telematics in Hamarøy. The project was organised as a limited holding company and should function as a development council and resource centre promoting the use of telematics both in the private and public sector (see figure 2).

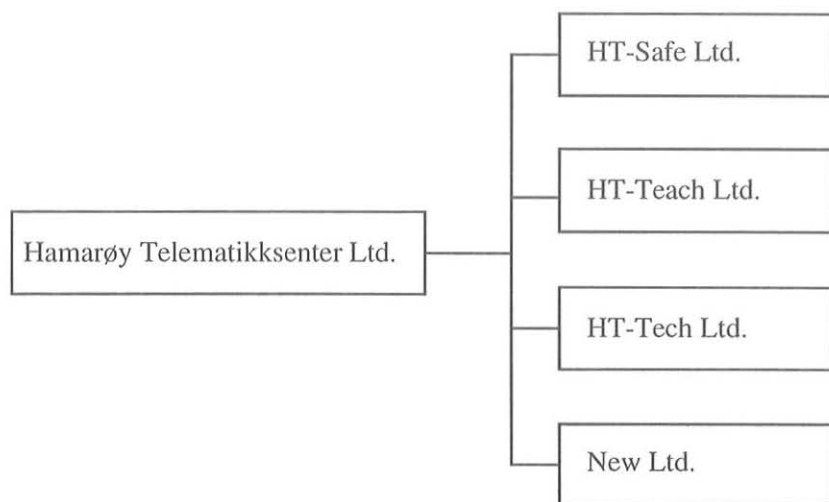


Figure 2 The Hamarøy Telematic Project

By the acquisition of the NOK 1.25 million and their organisation of the whole activity, the communal entrepreneurs had strengthened their definition of the obligatory passage point. The nucleus of the reorganised project was Hamarøy Vaktssentral (Hamarøy alarm monitoring centre), later named HT-Safe. From the beginning it was decided that the more commercial activities of the social experiment should rather rapidly be developed into commercial enterprises e.g. HT-Teach that organised vocational training and courses and HT-Tech that gave technical support. The company names were actually in English, and the reason for the English names was both to signal an international orientation, but also to simplify the marketing of the services on an international market.

The Devices of "Interessement" or How the Allies are Locked into Place

In the documents produced, the identified groups have a real existence. However, the entities and relationships are to be tested. The stage is set for a series of trials of strength whose outcome will determine the solidity of the communal entrepreneurs' problematisation.

The "telephone exchange women" are central at the very beginning of the story. They lost their original jobs and some of them were employed in the alarm monitoring centre producing mostly alarm monitoring services, switch board and secretary services for the municipal town-hall. The women participated in the different working-groups. However, in spite of all the information they got, or perhaps because of it, they felt unsure. They felt that they were losing their grip on developments and that they did not have the competence required. In 1986 it was apparent to the communal entrepreneurs that competence was a problem. First of all, the "telephone exchange women" had no competence in marketing, they were therefore dependent on other people to market the services. An attempt was made to compensate for this lack of competence by vocational training. Training in the use of different computer programmes, sales, languages (esp. English) and information handling were perceived as especially important.

However, their lack of relevant competence was still a problem and in 1986/87 it was openly said it was necessary to recruit employees on the basis of qualifications and motivation. This was perceived important for the communal entrepreneurs if they were to manage to enrol new allies in the private sector. The question of motivation has to be understood in relation to the working rhythm that the "telephone exchange women" were accustomed to. The numbers of processed calls were approximately 18 000 in 1984, 24 000 in 1985 and 28 000 in 1986. During the 24 hours there were approximately 35% calls between 08-15, 52% between 15-22 and 13% between 22-08. The working rhythm may be graphically displayed as in the following figure.

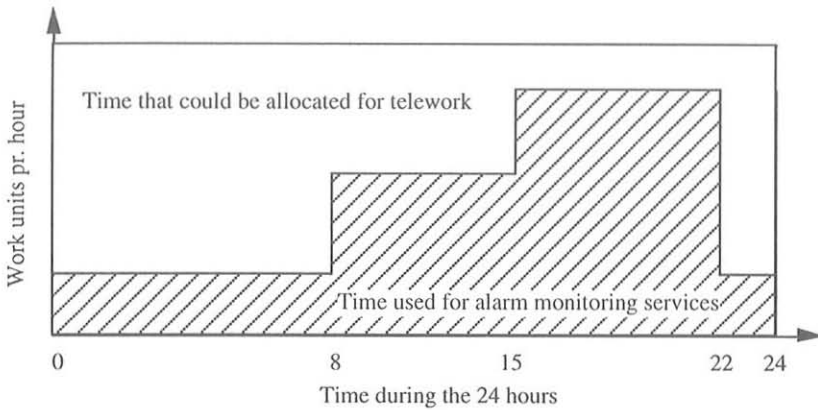


Figure 3 The niche of "idle" time

The communal entrepreneurs interpreted the working rhythm as a situation where one could "exploit" the niche of "idle" time for the production of telework, while the "telephone exchange women" were accustomed to interpret the "downs" as compensations for the "peaks". They understood that the lower level of routine services produced compared to the old manual telephone exchange had to be compensated by telework. However, they were never "motivated" to exploit the full amount of "idle" time since they never were fully enrolled for support of the translation from "idle" time to time for "telework".

The competence and confidence that the communal entrepreneurs had were important when they negotiated with the national actors. In the application to the Ministry of Local Government the communal entrepreneurs promised that the project in Hamarøy would fulfil four aims:

- 1) The project should act as a foundation stone for the establishment of new firms in the municipality in many years to come.
- 2) The project should during a three year period give results in the form of new jobs involving telematics.
- 3) The project should market Hamarøy as a remote municipality with bright prospects for the future, where a high quality of life and new technology could be combined.

- 4) The project should give central authorities new experience with how telematics could be used as an important tool in rural and regional policy.

One important step to ensure intersement was to formalise the link between the national actors and the local activity. When the pilot experiment was launched by the Ministry of Local Government, Telenor Research and Norwegian Research Council the summer of 1986, Hamarøy had signalled strongly that the municipality was an interesting test-bed for telematics (see chapter 6). The Ministry of Local Government therefore specifically asked for Hamarøy to be included in the pilot experiment. This status also gave Hamarøy new arguments when it later came to apply for financial support.

Two of the communal entrepreneurs were especially active in keeping the interest of national actors. The now chief officer of the municipality had close contacts to the Ministry of Local Government and, through the pilot experiment, he strengthened his contacts to the Ministry. The old mentor took care of another aspect. When the Nordic Association for Community Tele-Service Centres (FILIN) was established he was elected as treasurer, a position he held from 1986 until 1989. Through this position he got contacts all over the Nordic countries and FILIN also achieved the support of the Nordic Council (and thereby indirectly by the Norwegian Ministry of Local Government). One Nordic project that FILIN later got involved in was a cooperative project to stimulate further education and the mentor was given the responsibility as project leader. The aim of the project was to establish a network for communication between the Nordic telecottages. The project gave priority to the rapid establishment of a communication network. It was perceived more important to give the different actors experience with communication technology than the actual content of the communication. The importance of the content were expected to increase when people got the necessary experience.

To implement the communication network as quick as possible, it was decided to use the Videotex system and give priority to local Computer Clubs, agricultural extension service, local schools and finally "genealogical research". The schools were the most frequent users of the system, while more "commercial" actors were reluctant to communicate for the sake of communication. However, this project did try both to enrol the national actors, but also to enrol the technology in a more active manner, since it was

already a well known fact that in spite of a lot of symbolic use of the concept "telematics" the technology in use was both well known and trivial.

The adoption of modern communication technology illustrates several intersement mechanisms. The communal entrepreneurs were inspired by the ability of the technology to overcome distance. So far, in spite of all the possibilities, the technology had been used for solving rather local problems. It was therefore necessary to demonstrate the ability of new communication technology to overcome distance. The intersement, if successful, confirms more or less the validity of the problematisation. This was not yet achieved. However, the communal entrepreneurs had at least demonstrated the possibility for success.

How to Define and Co-ordinate the Roles: Enrolment

One can never be assure of future success. It is therefore important to demonstrate the actual success achieved, as this will be a guarantee for the likelihood of future success. The process of intersement does not necessarily lead to actual alliances or enrolment, and the crucial task is therefore to transform questions into actual statements. The communal entrepreneurs portrayed new information and communication technology as useful in producing and marketing new services. And not least, the project as a whole was portrayed as a "half" success. Half a year before the project money came to an end, the chief officer of the municipality reported to the Ministry of Local Government that:

- "1) The project has functioned as a foundation stone when it comes to basic investments in competence among the actors, in the technology and in a social and market related network beyond our own municipality. Telematics are today an integrated part of most development activities and the municipal organisation had got the most modern computer network on the market.
- 2) The project has directly given 4 new jobs. Indirectly it has supported 7 old jobs and 2 new ones. In the private sector 10-12 new jobs involving telematics were established. However, these two firms went bankrupt in the same period. None of them got any support from the Regional Development Fund. One conclusion is that the project has not given the anticipated effects in the form of new jobs. This is especially the case in the private sector.

- 3) The project has certainly been useful in the marketing of Hamarøy by media coverage in newspapers, journals and among relevant interested groups. An evaluation made by a private consultant gave a favourable picture of the project.
- 4) We have not been efficient enough to present our experience to central authorities. External evaluation will, however, be useful for actors outside the municipality”.

Some of the experience with enrolment was discussed. First of all they had not been successful in their attempt to establish jobs with the help of telework over long distances as the alarm monitoring centre at most had a regional coverage. The reason given for this was twofold. They had not had the capacity to follow up contacts in the Stavanger area, and technologically they had not been ready. They still believed that telework over long distances would prove a commercial possibility. However, new incentives had to be launched if it were to be possible to establish new jobs by telework. The chief officer of the municipality concluded

“that the field trial has not lasted long enough to make any decisive conclusions. Many factors indicate that telematics will be one of the most important tools for the development of new jobs in Hamarøy. To facilitate the relevant experience to be gained, while new technology increasingly are taken into use, not the least in the process of implementing ISDN, one had to construct a more specific project in Hamarøy”.

At this moment a new promising project is being introduced. In this new project one could explore different models for telework in cooperation with the private sector. The argument which the communal entrepreneurs developed in their earlier papers is repeated in 1988; “We have many indications of the fact that telematics can be one of the most important tools to develop new jobs in Hamarøy”. However, at that moment no jobs were established as telework over long distances. The second project had lasted for two years and now they felt comfortable that the technology was ready for a real start. A new project was planned; “Hamarøy as the locality for a North-Norwegian Telematic Sandbox” (an establishment of a project with the magnitude of the Jevnaker project, but located in Hamarøy, see the explorative experiment).

So to keep the interest of national authorities, new projects and problems are introduced. First of all, the experience in Hamarøy had been rather promising. However, telework is difficult and new technologies are constantly introduced. One needs therefore a new phase in the project, or a new Project. The communal entrepreneurs therefore tried to enrol national authorities by

focusing on the experience already gained, while underlining the experience that could be gained in the future.

The Mobilisation of Allies: Are the Spokespersons Representative?

The communal entrepreneurs had made themselves spokespersons of a heterogeneous group of allies. Were the results so far portrayed representative for the actual possibilities and problems? The alarm monitoring centre or HT-Safe did function. However, in the first six years it had not been possible to increase the number of employees. HT-Safe produced the expected services, but the economic results were disappointing. Was this an illustration of a misrepresented idea? The municipality didn't believe so; they saw the "half" success as a success. More time and more efforts would stabilise the economic base. The Ministry of Local Government knew that failures in rural and regional development are plentiful - a part success is often interpreted as a success. The telecommunication technology had proved its usefulness, several small innovations in the field of telemetry had been implemented - e.g. the monitoring of fish hatcheries was a successful innovation. By this innovation one also extended the network and managed to enrol the insurance companies for support of the innovation, since they would lower the insurance cost if the owners installed monitoring systems.

However, the communal entrepreneurs had doubts about their own strategy and assumptions. Some of these doubts are illustrated by the new project proposal. The support from the Ministry of Local Government had been used to implement a broad strategy, several companies had been established and telematics were also introduced in the schools and in the municipal organisation. This broad strategy may guarantee some successes, as when Scott's sledge was dug out, with its load of geological specimens. Huntford comments on this "victory" by stating that they had "dragged those thirty pounds of rock to show themselves martyrs to Science; a pathetic little gesture to salvage something from defeat at the Pole and the wreck of their hopes."⁶⁶ Telework was not really tested, but the municipality knew a lot more about new information and communication technology. In his last suggestion the chief officer of the municipality does signal that it is necessary to take a greater and

more concentrated risk. Risk reducing strategies may give some profits, but seldom big ones. However, I would say, had the communal entrepreneurs really made themselves spokespersons for greater risks, they would have had problems in gaining the necessary support of the different actants, and the network necessary would have dissolved.

A special group of potential allies needs to be discussed; the social scientists. The primary role of the social scientists was to evaluate the social experiments. However, the institutions that paid for our research also gave us an active role in the experimental process. We interpreted this role as a commitment to create an active dialogue between the researchers and the experimental activity. This interpretation was later confirmed by the steering committee of the pilot project. As an approach, dialogue research is well described in Danish experiments.⁶⁷

In our work the dialogue entailed regular meetings both in person and by the telecommunication system (we even experimented with some of the new technology!). The most important role, however, was to evaluate and discuss some of the problematic issues that the local experimenters had to struggle with. Several smaller and more specific evaluations were therefore made on behalf of the local experimenters. Two small reports were written on behalf of the communal entrepreneurs in Hamarøy;

1. "Welfare services for old people and the role of HT-Safe" (Meissner 4/87)
2. "Alarm monitoring services - activities for local telematic centres?" (Meissner 16/87)

The first report was about the use of telecommunications in improving the living conditions of elderly people. This is an important task since many of the young generation have left Hamarøy and the population is scattered with long distances between neighbours. The researcher concluded that the "social service", routine calls to 17 elderly people who were called every day by HT-Safe to ensure that everything was OK and if necessary organise different kinds of assistance, was an important and cheap way of improving the living conditions of elderly people. Furthermore, 8 persons had emergency alarms that could be activated if anything happened. The final conclusion of our researcher was that this kind of public services were extremely underpriced by HT-Safe and that the responsible authorities in the municipality could increase the payment to HT-Safe and still get a rather cheap service.

The other report concerned alarm monitoring services as a service for local telematic centres. In the conclusion, the researcher portrays the alarm monitoring service as a risky venture, specially in remote areas. There were two reasons for this. First that one need a minimum staff to manage the 24 hours around the clock service. Second that the local markets in remote areas are seldom large enough to sustain an alarm monitoring centre. However, HT-Safe was already running and it would therefore be a useful strategy to explore how this specific centre could extend its market and volume of services.

These two reports exemplify that the dialogue between the communal entrepreneurs and the researchers produced arguments that both could be used for reorientation of the activity, but also for a reframing of the problematic issues.

Controversies and Closure

How are relations stabilised and how are controversies solved? Why did the alarm monitoring centre have problems? First, the services were introduced at low prices and they had problems in introducing more realistic prices that among other things paid for the transaction costs (the customers saved much more money by the services than they had to pay for them). Second, the local or even regional market could not sustain an alarm monitoring centre with nearly 5.5 full paid man-labour years. Characteristically, nearly half of the income came from two supplementary services; the telephone switch and secretary service for the municipality town hall. Thirdly, the marketing of services was insufficient and first in 1986 a manager with responsibility for marketing were employed. Finally, the fact that public money still arrived did not stimulate increased marketing. HT-Teach that organised vocational training and courses and HT-Tech that gave technical support, found it difficult to launch economic activities that could make the firms sustainable on a distant market.

The communal entrepreneurs are portrayed as a homogeneous group. However, the group had their own conflicts and controversies. The chief officer of the municipality was the key person in this group, but also the youngest and most impatient. He engaged himself in all aspects of the activities, and

the old mentor therefore “created” a problem when he was elected member of the board of FILIN. Should the mentor represent the project in Hamarøy or himself? In the chief officer’s opinion, the mentor should represent the project in Hamarøy and therefore also promote the interest of the project in Hamarøy. The mentor found this position difficult and was more and more marginalised in the Hamarøy project. This was however a problem, since the mentor had very high social credit in the community, and when he withdrew from entrepreneurial team the ideas of telework and telematic centres also lost some of its local credibility.

Not only the conflict between the chief officer of the municipality and the mentor was a factor here. As a researcher I was associate member of FILIN and also member of the board. When the board members were refused full information about the economy of FILIN by the chairman of the board I resigned and informed the Nordic Council of my decision. The Nordic Council later asked the Swedish auditor-general for an investigation, and their report revealed that the very exemplar among the telematic centres, in Vemdalen, Sweden, had never been close to economic sustainability. As a member of the board of FILIN the mentor was increasingly dragged into the controversy in FILIN, and he also decided to resign from the board. Our experience had consequences for the credibility of the whole idea of telematic centres among actors like Telenor, the Ministry of Local Government and the Regional Development Fund. The breakdown of confidence was later an important factor to prevent the Regional Development Fund from investing in new projects.

When entrepreneurs make themselves spokespersons for new technology they enrol the technology as allies in their more overall project. The successes of the overall project are then dependent on the success of new technology and when the technology fails one will face the experience of Scott, when his last motor sledge broke down, that “The dream of great help from the machines is at an end!” and “A little more care and foresight would make them splendid allies.”⁶⁸ It turned out to be a problem, both for Scott and our telematic entrepreneurs, that the technology they enrolled was never really tested before it was implemented in their pilot projects. It was therefore problematic to enrol the technology for an even higher aim; the production of services that should sustain the hybrid community on the venture into Terra Nova.

During the last six years the different telematic activities in Hamarøy have closed down, except for the alarm monitoring centre. Why is the alarm monitoring centre still running when the municipality in 1994 had to pay 60% of the running costs? To understand this it is necessary to understand the local need for jobs as such. It was important to create new jobs, and it would have been a local success if this could be done in the market. The loser of the South Pole was later reframed as the hero. In the same manner the communal entrepreneurs started to negotiate about the frame of reference for success and failure of the alarm monitoring centre. The result of these negotiations was that the municipality accepted that the benefits from the alarm monitoring centre were important and saved the municipality money on several entries of the municipal budget. The municipality also accepted a higher price for the services that HT-Safe produced directly for the municipal town-hall. These negotiations and reinterpretations made it possible for the municipality to pay 60% of the running costs of HT-Safe.

The alarm monitoring centre in Hamarøy has now run for 12 years and the communal entrepreneurs eventually succeeded in stabilising the economy of the centre: not by making it into a success on the market, but by negotiating how the activity should be evaluated. However, the fact that the municipality would like to reduce their economic burden as much as possible, has made the alarm monitoring centre into a locus for new ideas and projects and thereby “institutionalised” its role as a test-bed for new innovations.

3. Testing Technology - The Idea of the Social Laboratory

Reducing Risk - Testing the Unknown

The two most important features of tests, I will argue, are that they 1) are *mechanisms* for defining or shaping the technology as such and that they 2) increase knowledge about new possibilities and thereby *reduce the felt uncertainty* about new innovations. In a very real sense, tests invent hybrids. Although testing is usually considered to be a means of measuring technical qualities that are already present in the technology, they also to a significant degree provide the technology with the qualities they purport to measure.

Testing may therefore also be seen as a process whereby we “inscribe” the qualities in the technology that we intend to measure - not after the testing, but by the sheer act of testing the quality. By this invention or reinvention we also acquire more knowledge about the innovations and reduce the felt uncertainty. This process of transforming technological images into “real” technology may also explain one important factor concerning technology assessments, and its influence on decisions. Many authors comment on it and Miles states that in the case of videotex, it seems common for trials to be started - but for the decision to go ahead with the full-scale service to be taken before their results were available. In these cases, there seems to have been an astonishing lack of interest in the - generally unpromising - results of trials conducted in pioneering countries.⁶⁹

The Inscription Process

Technological solutions are manifold. The selection among all these solutions is usually done in the market where we are all actors. In my terminology the market corresponds to the universe of users. Thus I am not dealing with the market as defined in economic theory as the place where supply meets demand, “but with the practitioners’ market, which essentially describes the state of

the demand - the identity of consumers, the nature of their "needs", their hierarchy of preferences (or, more prosaically, purchasing criteria), their organizational forms and so on".⁷⁰ As such we all participate in a massive experiment with all new kinds of technology. The laboratory in this respect is most of the industrial world. However, the developers of new technology, and this is especially the case with telecommunication technology, have often found it difficult to use the market as such as their laboratory, simply because it will be too expensive or impractical.⁷¹

During the last twenty years, the telecompanies have produced inventions and new products on a large scale and by this they are also taking big risks. Given this, the producers of technology and the providers of services have taken an interest in more controlled hybrid communities. The expressed motive for the creation of hybrid communities is therefore both to reduce the risk of expensive failures, but also to get important feedback in the development process (as the development process is also a learning process). The development process may in this connection be split into three interlinked activities; 1) The elaboration of technical possibilities, 2) The development of technical solutions and 3) The determination of preferred user-values. These three activities constitute the *inscription* process. See figure 4.

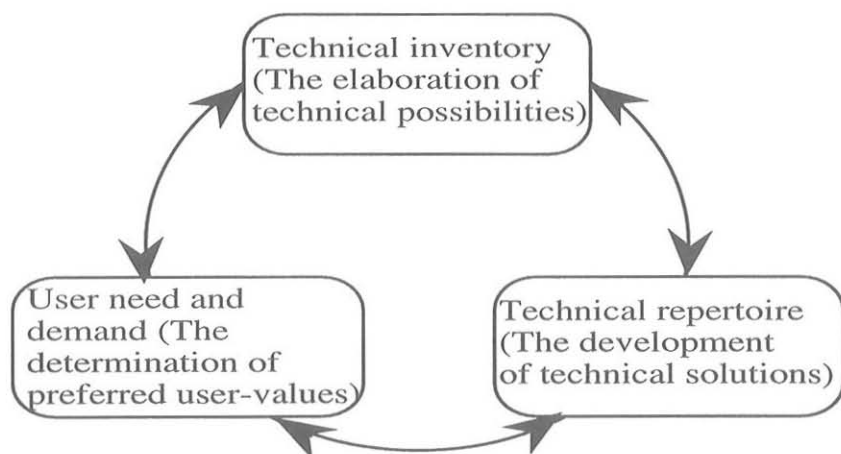


Figure 4 The inscription process

The technical inventory represents all the perceived possibilities. For a chef it represents all the utensils, ingredients and processes that he knows it is possible to use for the preparation of food. However, the chef has both limited resources and skills. He has a repertoire of dishes that he will prefer to make taking into consideration anticipated consumers' preferences, economy, etc. The consumers of his products then have to select from the menu. We see by this metaphor that it is possible both to enlarge and to decrease the inventory as well as the repertoire and the menu. This is also the case as far as technology is concerned. We have seen technological solutions as part of the inventory many years before they are actually developed and marketed.⁷²

Hybrid communities are staged both as experiments to enlarge the inventory, the repertoire and of course to determine or influence user needs and demands. As such, hybrid communities may represent a strategy to explore and control the future and to reduce risk.

The Different Roles of Hybrid Communities

Hybrid communities, which attempt to construct communication systems and applications in "real settings", and to establish how far they achieve the expected goals and what unexpected issues arise, are, in the diffusion of innovation model, given four different roles. They may be explorative experiments, pilot experiments, demonstration experiments and replication experiments.

With the concepts that social scientists impose on their data - are they talking about the same social phenomena with different sociological concepts or are the different concepts an elucidation of important analytical differences? A couple of more exploratory contributions in the field of hybrid communities try to handle some of these problems.

Elton concentrates on the distinction between "field trials" (explorative experiments and pilot experiments) and "demonstration projects" (demonstration experiments) and emphasizes that field trials are instruments of research while demonstration projects are generally not. However, he notes that this distinction often is blurred by some government funding agencies which find it administratively more convenient to use one term even though

it is the wrong one.⁷³ Qvortrup chooses to distinguish between “social experiments” and “social laboratories” claiming that:

“Social experiments qualify as “participatory workshops” if all the parties involved in, or influenced by, the development of the IT-system concerned, participate on an equal footing in decision-making with regard to the social organisation and application of the IT-system in question. If not - that is if the main subject is a hardware or software manufacturer or a third party - the social experiment may more appropriately be designated a “social laboratory”.⁷⁴

While Elton discusses the concepts in relation to the role of research, Qvortrup prefers to discuss the concepts in relation to users and producers and their involvement in the development process. This discussion may also be seen as a discussion of how different actors perceive the different testing situations and how researchers try to explain these differences.

The testing of technology is undertaken in a specific context. This context is a social and normative construction and the deconstruction of tests involves recognising the basic significance of how the researchers stage their tests. One strategy for this deconstruction is to study the projects according to what stage of the diffusion of innovation process at which the test is undertaken. Rondinelli's discussion of development projects as policy experiments is therefore useful.⁷⁵

According to Rondinelli, the concept of “social experiments” or “social laboratories” is appropriate for an exploratory situation when little is known about problems or the most effective means of setting objectives. Unknowns and uncertainties affect nearly all aspects of this type of testing; from the definition of problems and the feasibility of alternative interventions to the choice of the most appropriate technologies and organisational arrangements. “Pilot projects” or “field trials” can, however, be used to test the results of previous experiments under a greater variety of conditions and to adapt and modify methods, technologies or procedures that have proven to be effective in an other context to local conditions and needs.

A “field experiment” is therefore most appropriate when the problem or objective of a policy is well defined or when much is already known about the effects of small-scale experiments. “Field trials” are usually intended to test and develop new methods and technology, determine their relevance,

transferability and acceptability and to explore alternative ways of disseminating results or services. Rogers claim that

“A field experiment is an experiment conducted under realistic conditions (rather than in the laboratory) in which pre intervention and post intervention measurements are usually obtained by surveys. In the typical diffusion field experiment, the intervention is some communication strategy to speed up the diffusion of an innovation”.⁷⁶

When the pilot phase has been completed, demonstration projects can be used to exhibit the effectiveness and to increase the acceptability of new methods, techniques or forms of social interaction on a broader scale. Evolving from “social experiments”, “field trials” and demonstration projects we will find “replication” or “implementation”-projects. Widespread replication and full implementation can be undertaken when some of the uncertainties and unknowns have been dealt with, or when a great deal is already known about the elements or potential impact of a project that would ordinarily be tested in experimental, pilot and demonstration activities. However, all development projects are somewhat experimental and even seemingly routine replications often meet unanticipated difficulties when projects are transferred from one context to another.

While Rondinelli prefers to arrange the testing situations according to the diffusion of innovation model, Pinch distinguishes three different forms of testing - prospective, current, and *retrospective* testing.⁷⁷ Prospective testing is carried out before the technology is introduced, while current testing occurs once a technology is up and running. Retrospective testing takes place after a major accident or malfunction has occurred.

Given this short summary of different test situations we may therefore arrange our discussion of testing as a discussion of the role of different actors, the different phases in technology development or the circumstances that spark off the testing. The following four dimensions seem to be interesting:

- a) Participation (Qvortrup)
- b) The role of R&D (Elton)
- c) The innovation - diffusion process (Rondinelli and Rogers)
- d) Prospective - current - retrospective testing (Pinch)

More systematically, the dimensions may be arranged as in figure 5.

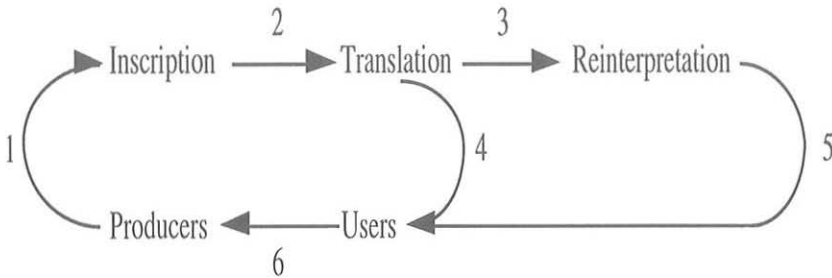


Figure 5 User-producer relations in technology testing

Elton emphasizes the importance of dimension 1, the process of inscription by producers (the role of R&D), while Rondinelli and Rogers underline the importance of dimension 2 and 3; the translation and reinterpretation by users (in their terminology; the innovation-diffusion process). Qvortrup underlines the importance of the comprehension and usage by users (4 and 5) and their participation in technology development by feedback mechanisms (6). Finally Pinch's version of prospective testing focuses on the process of inscription by producers (trying however to predict the implications of the other dimensions), while current testing encompasses all the other dimensions (and evaluates the implications of 2-6 according to the user-values inscribed by producers). His version of retrospective testing focuses on all the dimensions in a situation of crises or malfunction.

All these dimensions are important and should of course be open to empirical research. While dimensions 2 and 3 are highlighted in the diffusion of innovation model, the translation model takes care of all these dimensions. I have therefore arranged my four case studies in such a way that they may enable me to highlight some of the relevant problems. One important problem, however, needs a broader discussion, and that is the problem of how to understand user needs.

Understanding User Needs

In his discussion of user-producer relationships, Lundvall looks upon innovation as a collision between needs, problems and opportunities.⁷⁸ It has often been claimed that when a particular technology fails, the failure is caused by the fact that the technology does not meet a real "need". Very often the needs formulated are the result of a long process that has been stimulated by the fact that one becomes aware of possible solutions. The concept of "need" is therefore rather ambiguous and often misused in discussions about technological development. As Cook and Morrison point out, we may refer to four degrees of felt need; 1) Need felt and articulated in advance of the discovery or invention, 2) Need felt only after the discovery or invention, 3) Need not felt until long after the discovery or invention and 4) Negative need or actual objection.⁷⁹ One of the objectives of hybrid communities is therefore to gather more systematic experience regarding the interplay between needs and solutions.

Several researchers claim that their projects are "open" and that they focus on a range of possible needs. However, in the literature one often experiences that these projects soon restrict their outlook. In a telework project, Katz states that:

"The goal was twofold: to explore the potential of new workplace options; and to provide a formal evaluation process for future telecommuting projects. In order to make the best use of funds and personnel in this project, it was decided to focus on a comprehensive study of a single test subject".⁸⁰ The candidate for the test-study was very motivated and had a strong interest in becoming a telecommuter, since telecommuting would enable her to stay at home with her children. The test situation is then fixed to the testing of three software projects and the main objectives of the test are productivity and "morale". However, among the recorded results, we find the following statement: "During the project, the telecommuter was involved in continual self-analysis. This contributed to a reassessment of her career plans. She decided that she would aim for a managerial level responsibility and advance her professional career rather than raise a family (and become a telecommuter) at this stage".⁸¹

In spite of this striking result, the project is mostly discussed in a more narrow framework with focus on the technology as such. However, as the projects moved from a situation in which the solutions were manifold, to the testing of specific solutions, we may as well conclude that what was really tested was the user and her changing need, not the technology.

Need in our context is therefore a relative term, not absolute. Elton distinguishes between "need" as 1) a logical necessity (To speak with someone in another city without leaving my home, I need to use the telephone) and 2) need as "perceived needs" or "wants". Empirically, needs may also range from strong to weak and the strength of the need may also affect the perception of equipment and the willingness to live with technical problems.⁸²

Need is often treated as something that is stable over time. However, need changes over time and between different actors. Perceived needs may also be "surrogates" for a different category of needs and it may therefore be interesting to consider technical objects as "cargo" - and analyse the relationship between the users' expectations and the producers projected artifact. In the studies of Melanesian culture, the cargo-cult has been described both by anthropologist and missionaries. The natives observed that the missionaries got hold of all their precious cargo from aeroplanes arriving from the sky. They were convinced that the missionaries kept the secret of how to get hold of the cargo to themselves and the natives therefore built replica of the aeroplanes and waited for the cargo to arrive.

Market studies of information technology indicate that a large amount of technology is never deployed by the owner. This situation may indicate that many users either misjudge their own needs or that the equipment does not fulfil their expectations. One even more challenging interpretation is, of course, to look at the procurement of information technology as an important ritual in modern society (or a cargo cult) that, apart from the immediate and practical use of technology, is also the symbol of all important relationships and social status. The technology, or cargo is, in this frame of reference, expected to improve the owner's competence and status and thereby increase his ability to compete in a complex society. In this manner the technology is treated not as a "black box" but more like a "magic box", (neither its technical functions nor its user functions are taken into consideration). The technology is therefore mainly important for its anticipated symbolic and social functions.

Sometimes the telecommunication system is installed to meet one need, but is used to satisfy another. One well-known example of this is the Bethany/Garfield Picturephone trial. The picture phone was an apparent success, but when studying the use closer the researchers found that a substantial amount of the use derived from the fact that the ordinary telephone lines were occupied. Furthermore, perceived needs are not "stabilised" needs. One cannot expect the users to commit themselves to the perceived needs that they express. A large amount of wishful need assessments has unfolded a need for picture phones, videotex, etc., but when the potential users are given the actual choice they settle for other solutions. Need assessments have therefore often a fundamental weakness.

In the SITE experiment it was considered essential to assess the needs of the target audience. Initially, both "observed" and "felt" needs were to be investigated.⁸³ Later the anthropologist in the project recognised that the study of "felt needs" was an important element that had been missed.

"However, SITE researchers sought answers to some questions of considerable significance to science communication: What kinds of visuals will be understood by viewers? What will hold their attention? What kind of language will be understood by the villagers? What will interest the women? And the children? What will be good for the children? What format will be interesting and what will aid comprehension?"⁸⁴

Important questions, but mostly seen from the producer point of view. Technology providers have often a rather simplistic comprehension of needs. As Bandler tells us:

"At Pacific Bell, we look not to leading-edge technology but to the right technology for the market. We want the technology that will be cost-effective and will bring services that customers desire and need, at the appropriate place, price, and time. We view technology not in a vacuum, but in a market context. Technology is the solution, and we see this solution within the context of our customers' needs".⁸⁵

However, one purpose of need assessment is to help societies identify, plan for, and be responsive to those needs of its citizens that initially cannot be adequately expressed or addressed through the marketplace.

To stimulate user-producer relationships and thereby study the collision between needs, problems and opportunities the hybrid community or the “social laboratory” has been an important tool. In the following I will therefore look closer at the idea of the “social laboratory” and the ethnography of hybrid communities.

The Ethnography of Hybrid Communities

The ethnography of hybrid communities entail, if successful, that the anthropologist in his or her attempt to empathize with the participants in the hybrid community tries to tell the story also from the actors’ viewpoint; conveying their perceptions of the innovation and the implications thereof. This perspective also helps the anthropologist to overcome the pro-innovation bias discussed earlier. However, by choosing the approach of actor-network theory, not only the social actors but also the non-human devices enrolled in the network, have to be studied.

Considering artifacts as actors is rather common to large user-groups in Bénin, as Bénin is the original birthplace of voodoo. The practice of worshipping voodoo spirits (or fetishes⁸⁶) stems from the belief that God created hundreds of them, each with unique supernatural powers to affect human lives. Below the voodoo are the spirits of the dead and the priests. The priests are imbued with a part of the fetish and are the only humans who can communicate with the voodoo and the spirits. With a fetish called the “Telephone man” from Bénin it is possible to receive protection on long distance journeys. The telephone (as a symbol) is therefore also enrolled in the religious and cultural beliefs of many people. However the difference between the fetish and a technological artifact is important, since the purpose here is not to develop a new kind of technological determinism.

The everyday operation of testing implies a series of consequences. Hanson claims that tests do not simply report on apparently pre-existing facts but, more important, they are also mechanisms for defining and producing the traits and capacities that they supposedly measure.⁸⁷ The reason for this is that much testing is concerned to assess not so much what one has done already but one’s aptitude or potential to do it. Hanson elaborates his claim

and states that an important consequence of his argument is that tests act as techniques for surveillance and control of the individual in a disciplinary technology of power. This argument has also been presented by writers like Arbo, Jensen and Qvortrup.⁸⁸ Arbo discusses the growing interest in "social experiments" as a central method in the adhocracy and proposes that, as such, they are an important tool in a refeudalisation of society. Jensen and Qvortrup indicate that another tradition, too, survives: "*The control*. But it has been renamed, and furnished with new actors and a new content. Its *name* is "evaluation". It is *made* by "evaluation researchers"."⁸⁹ The last argument indicates that not only the acts but also the written text is an important part of technology testing.

This brings us, then, to a major issue in one of the ongoing debates among scholars: the issue of whether writers address actual readers external to their texts, or whether they appeal to an audience within their texts, teaching their readers through textual cues how to relate to and read a given text. When the first laboratory studies turned to the notion of a laboratory, they opened up a new field of investigation not covered by the methodology of experimentation. The focus upon laboratories extended the perspectives and allowed the researchers to consider experimental activity within a wider context of symbolic practices. They showed that scientific objects are not only "technically" manufactured in laboratories but also symbolic or political constructions by, for example, literary techniques of persuasion such as one finds embodied in scientific papers, where scientists act as strategists, forming alliances and mobilising resources; building scientific "facts" from within.⁹⁰

In an informative article about the relationship between experiments and the laboratories in science, Knorr Cetina emphasizes that there are at least three features of natural objects which a laboratory science does not need to accommodate. First, it does not need to put up with the objects as they are; it can substitute all of its less literal or partial versions. Second, it does not need to accommodate the natural object where it is, anchored in a natural environment. Laboratory sciences bring objects home and manipulate them on their own terms in the laboratory. Third, a laboratory science does not need to accommodate an event when it happens; it does not need to put up with natural cycles of occurrence but can try to make them happen frequently enough for continuous study.⁹¹ By this "liberation" from nature, the

laboratories are able to create their own world, and by this also enhance the symbolic value of the laboratory.

The laboratory as a symbol is not only recognised by social scientists, but also by the politicians who promote technology testing. In the way technology testing is set up, the tests involve negotiations, translations of interests, of political as well as cultural relevance. It is because of this heterogeneous mixing network of humans and non-humans, facts and artifacts, fiction and reality that technology testing is an analytical challenge to social science. Testing is therefore an important area to focus upon because testing can be seen as the attempt to specify formally and identify how the technology will perform, is performing, or has performed. As such, testing is a test case of the new sociology of technology.⁹²

Testing appeals to us through a wide range of synonyms used in daily life. Investigations, experiments, trials are just different methods to try or to prove knowledge of a certain "fact". The concept of testing is therefore strongly linked to the image of the scientific or industrial laboratory. With respect to hybrid communities in telematics there has been a great emphasis upon the laboratory as a symbol. But not only as a symbol: it has even portrayed the hybrid community as a laboratory experiment. This "inscription" has captured the imagination not only of technologists and social scientists, but also the lay public. In spite of this interest only a few researchers have found it worthwhile to penetrate the intimacy of the scientific or industrial laboratory. The problems and possibilities created when one links the image of a scientific or industrial laboratory with the concept of "social experiment" are however seldom discussed. Given this, it may be useful to look into the social dimensions of the scientific or industrial laboratory as such. How does one explain the shaping of technology?

The Shaping of Technology

Within the sociology of technology there are three schools that focus on the social shaping of technology: the "social constructivist", the "systems", and the "actor-network" approaches. The social constructivist approach sees scientific facts as social phenomena. Technological artifacts are socially constructed. Technologies emerge out of processes of choice and negotiation

between relevant social groups. Important concepts in this tradition are “closure” and “interpretative flexibility”. The focus is on design and development, which are seen as embodying the social processes; as encompassing the social interests which they represent.⁹³ Hughes’ networks, or “systems”, approach sees system builders - inventors, engineers, managers and financiers - creating and presiding over technological systems; and the heterogeneous networks of people, organisations and disciplines become parts of a “seamless web”.

The “actor-network” approach is a program for research which is more radical than the social constructivist agenda in that it collapses any distinction between the “technical” and the “social”. The actor-network approach is perhaps the most provocative theoretical approach of these three, and the theory that I will try to extend to the study of technology testing. The theory implies that both human and non-human actors are considered actors in the network.⁹⁴ However, both the concepts of relevant social groups, interpretative flexibility and closure are important analytical concepts that I will use in my application of the actor-network approach.

I will not try to settle the methodological and epistemological controversy between the different schools, but look into the studies of the scientific or industrial laboratories as a resource for understanding “social laboratories” or hybrid communities. I will focus on three aspects in this respect: a) The skill-like nature of experimentation, b) how facts become “true” facts and the use of the network concept and finally c) experiments and laboratories in the context of the wider society.

The Skill-Like Nature of Experimentation

The skill-like nature of experimentation is well acknowledged and in his interesting contribution “Changing order - replication and induction in scientific practice” Collins discusses how empirical results are replicable.⁹⁵ To sum up his conclusions in this respect: transfer of skill-like knowledge is uncertain and skill-like knowledge travels best (or only) through accomplished practitioners. Furthermore, the experimental ability has the character of a skill that can be acquired and developed with practice. Like a skill, it cannot be fully explicated, or definitively established. Experimental ability is therefore

tacit in its passage and in those who possess it. Proper working of the apparatus, parts of the apparatus and the experimenter are defined by their ability to take part in producing the proper experimental outcome. Other indicators cannot be found. When the normal criterion - successful outcome - is not available, scientists disagree about which experiments are competently done.⁹⁶ Tacit knowledge is therefore an important part of experimentation as it is an important part of social life in general.

Michael Polanyi described our ability to perform tasks skilfully without being able to articulate how we do them as tacit knowledge.⁹⁷ In studying informal employment systems in the Norwegian fisheries I found that tacit knowledge both was an important part of the socialisation process in small fishing communities, but also that the possibility of acquiring tacit knowledge is looked upon as an important quality by the fishermen.⁹⁸ So even if tacit knowledge as such is hidden, the fact that tacit knowledge exists is acknowledged. Technology can be designed to open certain options while closing others, the more options that are closed the more the technology limits the possibility for acquiring tacit knowledge.

In his discussion of open and closed technology in the Norwegian fishing fleet, Høst demonstrates how the trawlers are looked upon by the fishermen as closed technology that provide no possibility for demonstrating craftsmanship and the vast amount of tacit knowledge that they possess.⁹⁹ For this reason, the fishermen avoided taking employment on trawlers. Even in the apparently stringent world of natural science, tacit knowledge plays an important part. As Knorr-Cetina discovered, it may be difficult for even a co-author of a scientific paper to repeat an experiment without a lot of thinking or as she was told by one researcher: "There is a problem, of course, if one wants to replicate a result or repeat a method. As a rule, however, one does something else anyway. Hence, it is not so interesting to know exactly why and how certain things were done".¹⁰⁰

The strategy of keeping tacit knowledge tacit may be seen as a strategy for improving the scientist's own position and control in a game of power and influence. First of all, it makes the information difficult to access, and thereby renders the scientist strategic information. By this process the scientist "in persona" becomes a spokesperson for his own results, written documents are

not the only necessary source to reproduce his results. Secondly, it makes it more difficult to control both the scientist and his results.

By understanding the role of tacit knowledge one will also understand the root of experimenters' regress as Collins discusses it in his book.

"Experimenters' regress...arises because the skill-like nature of experimentation means that the competence of experimenters and the integrity of experiments can only be ascertained by examining results, but the appropriate results can only be known from competently performed experiments, and so forth. Other ways of testing for the competence and integrity of experiments, such as "tests of tests", turn out to need "tests of tests" - and so on".¹⁰¹

How Facts become "True" Facts

If nature did talk straight, then facts would be facts. However, facts are interpreted by scientists and, according to the third principle of Latour, we are never confronted with science, technology and society, but with a gamut of weaker and stronger *associations*. Thus understanding *what* facts and machines are is the same task as understanding *who* the people are.¹⁰² When we open the "black box" of scientific facts we find uncertainty, people at work, decisions, compositions and not least, controversies. This lead to Latour's third rule of method stating that the settlement of a controversy is the cause of Nature's representation, not its consequence, and we can never use this consequence, Nature, to explain how and why controversy has been settled.

Collins has a similar claim in his studies of experiments and the last three of his propositions illustrate the consequences of his earlier statements about replication. Where there is disagreement about what counts as a competently performed experiment, the ensuing debate is coextensive with the debate about what the proper outcome of the experiment is. The closure of debate about the meaning of competence is the "discovery" or "non-discovery" of a new phenomenon. Decisions about the existence of phenomena are therefore coextensive with the "discovery" of their properties. Finally, in the long term, phenomena with radical properties can only exist within forms of life and sets of institutions which overlap minimally with science as a whole. Otherwise, either the phenomena, or science, must change.¹⁰³

Both Latour and Collins agree that the scientific fact is a social construction. However, they have chosen different methods to arrive at this. While Latour ascribes to the actor-network theory, Collins has chosen a more traditional sociological strategy. However, the actor-network theory or actant-network theory, as Collins and Yearley would call it, is an important tradition in laboratory studies.¹⁰⁴ The same may be said of especially Collins' contributions within the tradition of the Empirical Program of Relativism.¹⁰⁵ Their epistemological controversy is well documented in "Science as practice and culture" (edited by Pickering) and in the ongoing debate in the journals of "Social Studies of Science" and "Science, Technology, & Human Values".¹⁰⁶

I will only elaborate on one aspect of this controversy since it is important in my own context, and that is the controversy about the use and meaning of network. This is important since Latour and Collins agree that we use networks of allies to establish scientific facts or, in the words of Gooding; "(Natural)Scientists' descriptions of nature result from two sorts of encounter: they interact with each other and with nature".¹⁰⁷

The Construction of Networks

Networks are an important concept in society and the economy. They abound as physical facilities, such as those of electric utilities, communications, and transportation. Networks are also relational systems, such as those of political supporters, the gang in the street, and strategic co-operation between firms. The first to give the concept of network graphic meaning was the anthropologist John Barnes in his study of "Class and Committees in a Norwegian Island Parish":

"The image I have is of a set of points some of which are joined by lines. The points of the image are people, or sometimes groups, and the lines indicate which people interact with each other. We can, of course, think of the whole of social life as generating a network of this kind."¹⁰⁸

The concept, so defined, has been used by a whole generation of social scientist to describe the systematic ordering of social relations by acts of choice and decision. In the social sciences, political scientists use the concept of networks in discussing hierarchies, interaction, gatekeepers, and policy

communities. For sociologists and social anthropologists, networks are a major way to see the world; a basic point is that the nature of linkage affects behaviour.

Collins adopts the concept of network, but as a metaphor - "a kind of spider's web of concepts".¹⁰⁹ Since he uses the network concept as a metaphor he refers to the "Hesse-net" advocated by the philosopher Mary Hesse.¹¹⁰ A Hesse-net shows how our generalisations are joined together in a network of generalisations, but the point on which Collins part company with Hesse's version of the model is the assignment of probabilities to the generalisation links in the net. "The network metaphor is exactly right but the links must be something else. *The links are the rules embodied and institutionalized in forms of life.*"¹¹¹ One of the reasons why Collins chose to use the network concept only as a metaphor is the fact that "networks look empirically unpromising, however exciting they may be as a metaphor".¹¹² One of his arguments in this respect refers to the analytical paper by Mark Granovetter.

The "innovativeness" embedded in the information and communication networks are often perceived as a reflection of the potentials in the network ties. Granovetter introduced a new dimension in this respect with his article on the "The strength of weak ties".¹¹³ Weak ties constitute bridges between different social networks and weak ties are therefore important for the diffusion of innovations. Weak ties provide actors with access to information and resources beyond those available in their own social circles. Actors and groups of actors with few weak ties are more likely to be less "innovative" than actors and groups with many weak ties. In relation to the flow of information, especially in geographical space, it is important to distinguish between different network-relations, between "strong" and "weak" ties. The flow of information is effective and extensive in what we may call networks with high density, consisting of multiplex or "strong" ties. It may be a strength to have many "strong" ties.

However in the context of innovation, the weak ties might be as important as the strong ties. Granovetter illustrates that the local "demand" without any local solution, may have better use for the more casual ties outside the local network. These ties are bridges to other networks and Granovetter illustrates how these bridges may function both as channels for recruitment to positions in more complicated employment systems and as innovation channels. For production units putting emphasis on innovation, it will be of importance to

get hold of *new* ideas. In this context the weak ties will be of great interest. They may be bridges between different social networks, and as such they may facilitate the diffusion of innovations. Weak ties provide people with access to information and resources beyond those available in their own social circles. But there is greater motivation to make use of strong ties, and they are typically more easily available.

So far we have very few empirical studies of the importance of weak and strong ties in diffusion of innovations.¹¹⁴ The reason for this is, among others, that weak links are difficult to investigate and this is precisely the reason why Collins finds them empirically unpromising. However, to counteract the problem of a network concept that comes to mean everything and finally means nothing, Callon and Latour offer a quite different network approach.

The Actor-Network Theory

Callon and Latour have chosen quite a different path to the network concept. In his paper on the scallops of St. Brieuc Bay, Callon set out the stage and the actors, or rather “actants” (as he include humans and non humans indiscriminately), for the development of the actor-network theory.¹¹⁵ The importance of the concept of an “actant” is that it cracks the wall between the social actors (who possess reasons and intentionality) and artefacts (which may “act”, but without purposes of their own). An important argument in his theory is that the actors are “represented” by spokespersons, that try to act in the name of all actors in the network. Callon sketches the way that the translation may pass through in four stages, during which the identities of actors, the possibility of interaction and the margins of manoeuvre are negotiated and delimited:

- 1) The problematization or how to become indispensable
 - a) The interdefinition of the actors
 - b) The definitions of obligatory passage points
- 2) The devices of “interessement” or how the allies are locked into place
- 3) How to define and co-ordinate the roles: enrolment
- 4) The mobilisation of allies: the spokespersons as representative

To follow this process Callon decided to obey faithfully the following three methodological principles. The first principle extends the agnosticism of the observer to include the social sciences as well. He hereby refrains from judging

the way in which the actors analyse the society that surrounds them. The second principle is one of generalised symmetry. Natural "actants" as well as human actors are to be treated symmetrically. The third principle concerns free association. The observer must abandon all a priori distinctions between natural and social events.

The actor-network theory has been used to analyse different large technological projects, often based on extensive R&D-activity, some examples are the British TSR-2-plane¹¹⁶, the Concord-plane¹¹⁷, missile guidance systems¹¹⁸ and a new subway system for Paris¹¹⁹. The advantage with this kind of project is that it is relatively easy to determine the actors and the spokesperson(s). The fascination for the laboratory that often are embedded in these stories has perhaps given the laboratory a too important role in the development of the actor-network theory. Less clear-cut stories where the products leave the laboratory and are put to test on the market are perhaps necessary to develop the actor-network theory further.

Brosveet emphasizes that the translation from invention to later phases in the product-cycle makes it more difficult to follow the different spokespersons and scenarios that follow from the following two circumstances¹²⁰:

- 1) The development of technology based *services* instead of products.
- 2) The *usage* of technology based services instead of the development of technology based services.

However, several scientist have validated the translation model in the study of services, like videotex, accounting and information systems.¹²¹ Furthermore it is validated in studies of public controversies, science and technology communication.¹²² Critical commenters of the translation model most often use examples from invention or discovery.¹²³ It seems therefore that in the continuum circumscribed by the innovation concept (without claiming any linearity), the translation model has caused most controversy in the invention or discovery end of the concept, while least controversy in the diffusion, dissemination or communication end of the concept. If this is correct it may also of course reflect the richness of alternative innovation models, and the poverty of alternative diffusion models.¹²⁴

The descriptive and explanatory power of the model is well documented and I have therefore chosen to elaborate (on some parts of the translation model or actor-network theory) on problems that are mostly concerned with the communication, transfer and reinvention of technology. I will do so by

adopting an anthropological or cultural approach and try to analyse technology as a product of four distinct spheres:

- 1) conception, invention, development and design;
- 2) marketing;
- 3) appropriation by users; and
- 4) policy.

This is in line with what Mackay and Gillespie try to do, except that I will include the policy sphere more explicitly. These spheres are not discrete, causally related, or sequentially ordered. Rather, they should be seen as heuristic devices.¹²⁵ Even if the spheres are not discrete, causally related, or sequentially ordered a simplified overview of important relationships is given in figure 6.

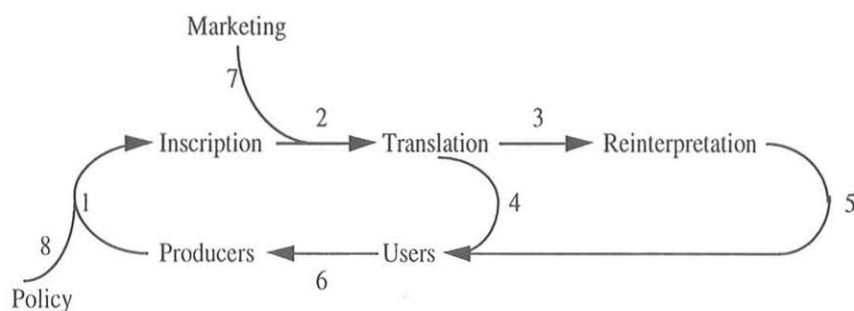


Figure 6 The translation model in technology testing

The figure is an extension of figure 5, but now includes the role of marketing (7) and the role of policy (8). Both marketing and policy influence the relationship at all stages of the process. I have however, illustrated where the most important impact is taking place. These activities occur more or less simultaneously, and are not necessarily stages that follow one another in a sequential order. One way of approaching this process is to follow the negotiations between the producer and potential users, and to study the way in which the results of such negotiations are translated into technological forms.¹²⁶ Thus, with the focus on technical objects and not the “cargo”, we have to recognise the interplay between the designer and the user, between

the producers' projected user and the real user. Figure 6 illustrates the translation model that I will apply in this book on the study of technology testing in hybrid communities.

However, it is important to remember that technology also has intrinsic qualities, in spite of Latour's second rule of method.¹²⁷ An example is given by Benguigui in an article about polywater where he challenges the actor-network theory by documenting that polywater was a failure, "precisely because in the end this water was *only* a social construction".¹²⁸

Experiments and Laboratories in the Wider Society

So far I have elaborated on the skill-like nature of experimentation and how facts become "true" facts. Last I will discuss the links between experiments, the laboratories and the wider society. Organisationally, science is conducted in experiments, while laboratories provide the infrastructure for the conduct of science - be it resources, manpower or problems. In former days the individual, the genius, was the focal point of science and the development of science. However, with the institutionalisation of science, the power of experiment has been identified more and more with the laboratory as the institutional setting. Latour demonstrates in a fascinating account how Pasteur established the power of an anthrax vaccine by moving between the laboratory and the field and thereby illustrates how experimenters may expand their space to include the world outside the laboratory and, eventually, the whole of society.¹²⁹

As mentioned in footnote 71, it is also possible to construct "laboratories" by creating specific user groups such as "zappers". This implies that it is possible to enrol user groups that will participate in laboratory experiments or laboratory testing at their own cost, which underlines the importance of studying marketing and appropriation by the users. The laboratory is therefore not necessarily a fixed place, but may also be perceived as an analogous space or hybrid community where it is possible to attract or regulate those who use its product. The laboratory is therefore a "space" where it is possible to distinguish between the insider and the outsider by enrolment or exclusion.

At the outset I stated that I would recast the roles and look at the participating users and see them as researchers that try to cope with different

technological possibilities and hindrances as the technology is their object for research, trial and error. This is important since, where end-users have an active role to play, their function is usually, according to Hartley, one or more of the following¹³⁰

- 1) to act as "guinea-pigs"
- 2) to perform R & D and undertake innovation
- 3) to become informed about IT
- 4) to be the primary subject(s) under study.

The roles of the "guinea-pig" or of "becoming informed" are the roles often designated to the end-users in hybrid communities enrolled under the diffusion of innovation model, while the more active R & D role of end-users or the role of primary subjects under study are roles more clearly expressed in the translation model. In spite of the fact that the designated role of end-users may differ, I will claim that some of the problems of the diffusion of innovation model derive from the fact that *end-users always make interpretations and translations*.

However, it is important to get a better understanding of how hybrid communities find their resolution and closure. In this analytical process, one finds parallels in the study of scientific controversies. The contribution of the study of scientific controversies is most apparent in the book "Scientific controversies. Case studies in the resolution and closure of disputes in science and technology" edited by Engelhardt and Caplan. Different contributors present an extensive discussion of controversies like the efficacy of Laetrile, the classification of homosexuality as a disease, the setting of safety standards in the workplace, and the utility of nuclear energy as a source of power.

Two of the contributions deal more specifically with the problem of closure. Beauchamp characterises five modes through which controversies end.¹³¹

1. Sound argument closure occurs if, and only if, a correct position has been reached in a context of controversy, thereby rendering opposition view incorrect.
2. Consensus closure occurs if, and only if, in a context of controversy a consensus has been reached that some position is best and that other views are incorrect.
3. Procedural closure occurs if, and only if, an issue is ended by formal procedurally governed efforts to terminate the sustained discussion that characterises the controversy.
4. Natural death closure occurs if, and only if, a controversy has come to an end through a gradual natural death, e.g. fading away because of waning interest.

5. Negotiation closure occurs if, and only if, a controversy is settled through an intentionally arranged and morally unobjectionable resolution acceptable to the principals in the controversy. The negotiation is a process, and compromise is the outcome.

McMullin offers a slightly different classification of the termination of disputes concerning science and technology.¹³²

1. Resolution: A controversy is resolved when an agreement is reached on the merits of the case in terms of what the participants take to be standard epistemic factors.
2. Closure: A controversy reaches closure when it is terminated on the basis of non epistemic factors, such as the authority of the state; the pride, ambitions, or laziness of a controversialist; or the withdrawal of publication facilities.
3. Abandonment: Controversies may terminate through participants losing interest.

These two classifications, although they differ, are helpful because they underscore the different roles played in controversies by epistemic and non epistemic factors. Epistemic factors are knowledge based factors and therefore internal to the understanding of e.g. an experiment. Non epistemic factors are factors external to the undertaking of the same experiment. The concept is context-dependent and some may therefore view non epistemic factors as epistemic factors. However, closure is the result of a process of “negotiations” and if the term “process” is to be of any use analytically, it must point towards something that controls and influences the activity, something that limits and canalises the possible course of events. My objective is therefore to explain the “black boxing” of hybrids and “facts” starting out from the processes that generate these very forms.

The Analytical Scheme in a Nutshell

The analytical scheme circumscribes three analytical levels. On the first level each of the four case studies is analysed as a hybrid community in itself, described by the analytical framework of the translation model of innovations. The important actors are described, how they try to enrol support and build strong associations of actors and artifacts. By concentrating on the spokespersons and their efforts to stabilise an obligatory passage point, I reveal that the problem of closure or stabilisation first and foremost is a problem of stabilising the obligatory passage point. First when the obligatory passage

point is stable is it possible to build a successful network. The earlier in the process of innovation the more difficult this is.

On the second level, I enrol the problem of context. It is obvious that context matters for the outcome of hybrid communities. This claim is not very revealing and I therefore concentrate on how one frames context, to enable analytical insight independent of time and place. The problem of double framing is discussed.

On the third level I enrol the problem of technology policy. How do we understand hybrid communities with the help of the translation model on a policy level that includes both technology push and demand pull? An important aim of this book is to give some guidelines for the use of hybrid communities in technology policy, both in relation to demand-pull and technology-push strategies.

4. Images, Policy and Practice

Shaping Frames of Reference

In the literature on telecommunications and development, we are told over and over again that there are more telephones in the city of Tokyo than there are in the continent of Africa. How are we going to bridge this gap? By taking a closer look at the more overall framework of communication development, Jussawalla identifies an epistemological shift in development communication theory over the last three decades.¹³³ Starting with the modernisation paradigm of technology transfer to developing societies, communication theory moved through a phase of dissociation - dependency strategy and the movement for a New World Information Order to yet another development model aiming at grassroots or participatory communication policies for achieving economic growth.

Common to all three paradigms is, however, the perception of distance as a problematic issue in development. Often distance is perceived as a barrier, and it is therefore interesting to analyse the interplay between technological solutions and the perception of this barrier. In this frame of reference the possibility of substituting for the "hardship" of travelling is perhaps the most important in peoples imagination and this perception is also important when it comes to the testing of new telecommunication services.

Telecommunications and the Information Economy

The interaction between users, producers and new technology is observable when the new artifacts are put to test. In doing so we are not only testing whether the technology really works, but we are also testing the diversity of possible uses. The dialogue between users, producers and technology may reveal both unintended consequences and unanticipated possibilities. Many of the tests take place in an open environment in which the market is included: determining and creating new needs and solutions among both users and

producers. This extension of the test environment makes it necessary to elaborate on the concept of infrastructure.

Since the telecommunication system is the world's largest machine it clearly belongs to what Hugh calls "large technological systems". Characteristic of large technological systems is their ability to acquire momentum. "They have a mass of technical and organizational components; they possess direction, or goals; and they display a rate of growth suggesting velocity. A high level of momentum often causes observers to assume that a technological system has become autonomous".¹³⁴

The concept of infrastructure in industrial society was closely linked to the network of investments that made the co-ordination of modern industrial activity possible. The concept was therefore used for physical facilities, such as electric utilities, communications, and transportation which serve the social and economic needs of a given locality. Infrastructure thus consisted of both very "visible" and "decisive" structures. However, a new type of enhanced communication infrastructure has arisen with stronger emphasis on developing market places and not only eliminating the physical problems of communication, but also enhancing our communicative abilities.

The history of telecommunications over a period of hundred years illustrates this development. The networks of the first telecommunication companies were plain networks transferring a message from one place to another along the shortest distance between two points. In the countryside, farmers even organised their own private lines, stringing wire from fence post to fence post.¹³⁵ As these first-stage networks expanded, however, it was discovered that in the world of the network, a straight line is not necessarily the best way to get a message from one place to another. This realisation started a process of creating new user-values within the network. Today we are creating an even more sophisticated third-stage network. Millions of computers are linked to form an even denser mesh. These new networks will not only route and reroute messages, but actually "learn" from their own past experience; forecast where and when heavy information loads will be, and then automatically expand or contract sections of the network to match requirements. While this process is not yet completed, we are moving into a fourth-stage system of intelligent networks.

Until now, the intelligent networks have been straightforward. The networks deliver messages precisely as they are sent. But the fourth generation of networks not only transfer data, they analyse, combine, repackage, or otherwise alter messages. We are talking about "Value Added Networks", or VANS. For example, the French Minitel network, which links several million users, offers services that can accept a message in French and automatically deliver it in English, Arabic, Spanish, German or Dutch.¹³⁶ While some of these services are only in their initial stage, the point is that now we are creating a network with quite different abilities than simply transferring messages from one point to another. This transformation from plain old telephone systems to integrated service systems will also alter our concept of infrastructure.

Several authors have tried to illustrate what the largest machine in the world, the telecommunication system, in fact means to modern society. To give an illustration of the total volume of communication that take place in this super machine I will use the picture drawn by Helge Godø.¹³⁷ From 1961 to 1981 Norwegian telephone traffic multiplied 5 times. If we assume that an average Norwegian telephone call takes 3 minutes, the figures for 1986 leads us to estimate a total number of 8,5 billion 3 minute telephone calls or a total time-consumption of 425 million telephone-hours involving at least two persons; Altogether, 850 million telephone hours. To understand the scale of this one may compare it with employment in Norwegian industry. Norwegians are close to using as many hours on the telephone as they use in the manufacturing sector for production. From 170 million telephone-hours to 850 million telephone-hours 25 years later, gives a strong indicator of what is happening to the time-budget.

New Telecommunication Services - "Successes" and "Failures"

People use the telephone to organise their work or private lives, participate in transactions, or just chat with family or friends. In doing so they are also actors in a social network; acting at a distance. However, in this network one finds not only social actors, but also the telephones, the transmission lines, the exchanges and all the necessary technology that make this network into a super-machine.

A wide range of new telecommunication technologies has been introduced to the public in most countries during the last few years, and even more technologies are forthcoming. This introduction of new communication technologies and, thereby, services are partly market or demand driven (demand-pull), partly vendor or supply driven (technology-push). However, in spite of considerable experience with new services, it seems difficult to forecast which of the new services will be "successes" and which will be "failures".

The criteria for success or failure are several and it is therefore difficult to discuss this without taking into consideration the relevant social groups and their criteria for evaluation. Many of the demand-pull studies compare successful and unsuccessful innovations and suggest that user need is important to success. Chidamber and Kon claim this is tautological, since it is unlikely that innovations not sensitive to user needs could survive. They conclude that

"all the authors are willing to state their preference for either market or technical factors, but leave to the reader the conceptual building of the relationship between market indicators and underlying changes in the technological base. They have demonstrated that both market need and technical capability are necessary conditions for innovation success, but have not demonstrated that either is alone a sufficient condition."¹³⁸

It is an important tradition in diffusion of innovation studies to strive towards better methodologies for the assessment of innovations. In a more recent study, Antonelli discusses the diffusion of information technology and the demand for telecommunication services. He emphasizes, in a more neo-epidemic approach, that recent developments in the analysis of the determinants of the diffusion of new technologies have highlighted the strategic role of externalities in assessing the effects of the diffusion of new technologies. Both adoption externalities and communication externalities are discussed.

"Adoption externalities include the provision of information to late adopters, i.e. the reduction in cognitive asymmetries, as well as increase in profitability of adoption engendered by reduction in adoption costs. Such profitability is made possible by classical pecuniary and technical externalities, such as the provision of skilled personnel, increased technical assistance that both

increase with the number of adopters and *communication externalities* that arise from the collective use of the same network."¹³⁹

In a more specific study Jeppesen and Poulsen examine the life cycle of teletex in the light of externalities and the installed base theory.¹⁴⁰ By installed base is understood the number of subscriber lines to the service as well as the size of the compatible customer premises equipment. The installed base theory represents therefore a more detailed discussion of communication externalities. In a policy document on Norwegian telecommunication development, submitted in 1980, the policy authorities made a forecast that Norway would have 7100 telefax subscribers in 1993, while the teletex¹⁴¹ service would replace the telex and increase to 9100 subscribers in 1993.

By 1991 there were already over 90.000 telefax machines in use, while the teletex service had to be terminated in 1993 as a complete failure. Jeppesen and Poulsen explain this by the fact that demand for teletex terminals from the beginning was hampered by their high price. Later, when the telex user base began to decline because of the rise in the use of telefax, the teletex system faced a reduction in its value as a communication system. This stimulated a migration of potential subscribers of teletex to other systems such as telefax and e-mail.

These neo-epidemic approaches represent important improvements on the original diffusion of innovation model. However, adoption externalities and installed base theory only partly explain innovation failures and successes. Rogers, Antonelli, Jeppesen and Poulsen are all searching for both intrinsic and relational qualities that may, if we know about these qualities beforehand, save much money and effort used to develop technology that never succeeds in the market.

These criteria may be heuristically useful in technology development but they are by no means sufficient to determine whether a specific technology will succeed or fail in the market. The process of innovation is complex and if one looks into the whole range of new telecommunication services one finds that:

1) Some have been a success in most countries. The telefax is a good example in this respect (after it was standardised by CCITT in 1979: telefax was a failure prior to this).

2) Some have been a success in some countries, but so far have not taken off in other countries. For example the videotex service in France compared with the same service in most other European countries.

3) Some have never taken off in any country, as for example the videophone.

The shaping of communication technology depends on implementation and usage in a specific cultural, social and organisational setting. It is therefore the main aim of this book to develop an analytical framework that enables an assessment of communication technologies without, at the outset, ascribing to the belief that intrinsic qualities of the technology or a superficial perception of user "need" determine the fate of innovations.

The steady stream of both technological successes and failures are often introduced as part of a broader vision about the new society - the post-industrial society.¹⁴² The linkage between this greater vision and the introduction of different artifacts is another of the topics of this book. I will therefore explore different aspects of the communication process between relevant social actors, e.g. the technology producers and policy makers' perception of the user, user "need" and user interface in telecommunication development. In the context of telecommunication development I will analyse the communication processes i.e. in what respect is technology development an interactive process between users and producers? How do different scenarios of technology development influence the perception of technological possibilities both among producers, policy makers and the end users?

Massive research and development resources have been put into technology-push strategies in most industrialised countries: creating what is popularly known as Pretty Amazing New Stuff or PANS. However, in the developing countries, the introduction of new telecommunication services is mostly demand driven and it is mostly Plain Old Telephone Services or POTS that catch on. Even if POTS is well-known technology from the industrialised countries, the implementation process differs from the implementation process in the industrialised countries (cf. Antonelli's adoption externalities).

While POTS developed from small local networks in the industrialised countries to an international super-machine with about one billion users in reach, in the developing countries it has developed the other way around. It started with the international connections from the capitals of the colonies to

the centres of the colonial empires and only slowly developed into more local networks. This fact makes the developing countries an important point of departure for understanding the shaping of even a well known communication technology like the telephone. How is the same technical artifact understood by different relevant social groups? How are the technical artifacts we call telephones reinterpreted and taken into use?

Telecommunications and Rural Development

During the last 30 years, concepts such as intermediate technology, appropriate technology etc. have been discussed extensively in connection with technology transfer from industrialised countries to developing countries and regions.¹⁴³ The notions intermediate technology and appropriate technology have first and foremost been used about production technologies - technology that is developed to transfer "nature" into "culture". *However it is too imprecise to analyse the information technologies as if they only represented a portion of the technologies in general, because essentially, information technologies are tools of interaction and organisation: you cannot use them to till the soil, or to hammer.* But you can use them to plan the tilling, to control and administer the hammering and the person who uses the hammer, to calculate, interact and organise. In other words, information technologies are not used to manipulate nature directly, but to manipulate cognitive, interactive and organisational processes which are important in the former.¹⁴⁴

Control over information and communication technologies is therefore a basic element in the distribution and control of power. So far we have seen that communication technology tends to strengthen social and economic relations and structures rather than change them. Since it is of no analytical value to ascribe intrinsic qualities like "intermediate" or "appropriate" to specific artifacts of information or communication technology, I will not use such notions but rather underline the importance of situating the use of technology in a more overall strategy for socio-economic development.

There is not only a quantitative, but also a qualitative difference between traditional manufacturing technology and information and communication technology. The massive development of new information and communication technologies that took place in the industrialised countries must therefore be

viewed in this perspective i.e. to strengthen both industry, public services, research and education.¹⁴⁵ This development will also have impacts on economic and social development in developing countries, and both directly and indirectly, on the international distribution of power.

Parallel to the relationship between developing countries and industrialised countries, or between the powerless periphery and the powerful centre in the industrialised countries, the development of information and communication technology strengthens the centres of these countries to the detriment of the periphery in the same countries. In a more historical perspective, the distribution of new information and communication technologies is closely connected to the development of industrial society and an effective two-ways communication system is an important part of economic development as we know it today.¹⁴⁶

In this respect, a stronger emphasis on a well functioning information and communication infrastructure in the developing countries and regions will be of increasing importance. Policy questions in relation to how information and communication technologies should be used to improve local and national development will therefore be important both for the individual country and the development organisations. An important element in this discussion is how different strategies towards economic integration have different info-communicational implications.¹⁴⁷

One important element in economic integration is the infrastructure for transport and communication. As far as rural development is concerned, one may distinguish between transportation of people, products and information. In figure 7, I have illustrated how different new telecommunication applications may be classified on these dimensions.

Traditional physical transportation of:	is substituted/extended by information transport via the telecommunication network:
People	Telework Telemedicine Teleconferences Distance education
Products	Distributed production
Information	Telefax Electronic Mail Electronic Banking

Figure 7 Transport substitution/extension by telecommunications

Technically speaking, it is possible to substitute for lengthy and time-consuming transportations of people to work, to the physician, to meetings, to school etc., with solutions in the telecommunication network. When it comes to transport of products, the distributed production may also substitute physical transportation. While much social research has focused on solutions that substitute transportation of people by transportation of information, it has been new forms for transportation of information that have evinced extraordinary growth. One important reason for this growth is to be found in the features which characterise the transition from an industrial society to an "information society". A certain shift has taken place in product composition, from raw material-based products to know-how-based ones. This leads to a greater emphasis on *direct personal contact* within the enterprise itself as well as between enterprises. In addition, the life cycle of the products has steadily decreased, which leads to a greater emphasis on product development. In other words, there has been an increased emphasis on market relations, creativity and the ability to innovate. These changes give greater importance to the hybridisation paradigm since the changes also assume personal contacts in fast changing network alliances.

Hybrid communities may therefore be one strategy to enhance our knowledge of new information and communication technology and the important potentials and problems of this technology. In the context of rural

development an important reason for experimentation with new information and communication technology is, however, also found in visions about the telecommunity.

Visions of the Telecommunity

While science fiction is the literary genre for studies of the future, scenario writing is the more "scientific" genre. When the Norwegian Tele Commission started its work in the beginning of the 1980s they asked a social scientist to write a scenario. This scenario is called "The future of society, a responsibility for telecommunication technology? Six future images delivered to the Tele Commission". The scenario was later published as an appendix to the report, but more importantly it is "translated" into the text of the report. The Maitland Commission did not feel the need for scenario writing: they had the industrial countries as a frame of reference.

The pace of technological change has led people to wonder about the shape of the future and the Frankenstein monster of Mary Shelley is now only a bleak version of scientific possibilities from the laboratory. However, the history of science fiction is also the history of modern man's changing attitudes toward time and space. Important works of art and literature such as the works of Mary Shelley, Jules Verne, Aldous Huxley and George Orwell illustrate the changing attitudes toward time and space as they are perceived in different images. The fusion of science and fiction is dominant in the science fiction literature and some of this literature has even an "aura" of authority since some scientists transfer their scientific authority into the world of fiction. In this way, science fiction is an important part of "modernity" and the development of "virtual realities" reflects the blurred borders between fiction and reality.

Myths and fairy tales are the very ancestors of modern fiction and through art and literature we create images that guide our thinking and frame our action. While myths and fairy tales try to teach old values, resisting the new, science fiction tries to grasp and handle the powerful changes that are embedded in modern science and technology. Our ancestors perceived time as an endless stream of repetitive acts, the future was simply a continuation of the present - until the end of the world. "Modern" man, from the end of

eighteenth century, has been forced to perceive the world in new ways. The future was both real and unknown, stimulating and terrifying.

This future shock has stimulated writers to introduce pieces of future images into our own world and thereby alter our perception both of the present and the future. Writers like McLuhan, Naisbitt, Toffler and Postman have been influential in shaping our perception of the "information society". These kinds of writers are not acting as the more trivial part of science fiction, nor do they present their writing as "pure" science. To a certain degree they are like the Delphic oracle, giving clues to the future. However, several of the writers in more futuristic literature acknowledge their debts to science fiction and Toffler states explicitly:

If we think of today as truly revolutionary, ..., as a period that will test every human capacity, then, it seems to me, science fiction has a special rôle to play in enhancing our abilities to adapt. To begin with, it forces us to question all the assumptions of the dying industrialism: assumptions about body and mind; about society, technology, politics, beauty, communications and religion.... I would argue that science fiction is basically pro-human, and for that I thank you, the writers of science fiction, for your contributions to me personally, to my rapidly transforming world, and to the future. Please don't desert tomorrow.¹⁴⁸

This perceived transition from the industrial society to the "information society" has not only caught the imagination of Alvin Toffler, but large groups of policy makers and writers. Often this transition is perceived as a gigantic "social experiment" and Toffler has even described this transition as a move towards the *telecommunity* or in his own words "...one of the key steps that can be taken toward building a sense of community into the Third Wave is the selective substitution of communication for transportation".¹⁴⁹

Time and distance have been barriers which have complicated human activity, but these complications have also been the point of departure for the development of advanced transport and communication systems. Telematics¹⁵⁰, the integration between tele-technology and information-technology entails a revolution in communications. Different pictures have been drawn to characterise the future, for example two large and detailed pictures of the "information society" in "Megatrends" by Naisbitt and in the "The third wave" by Toffler. The situation in the developing countries is depicted by the

Maitland Commission in "The Missing Link", while more Norwegian scenarios are drawn in the work of the Tele Commission of 1980-83.¹⁵¹

In 1983, the Tele Commission of Norway submitted its report entitled *Telematics*: transmitting the message that the "information society" was soon to arrive, underlining the fact that

there is a well established linkage between the level of development of a society and the infrastructure for communication. To day it is fundamental for the growth and development of a modern society that it has a strong capacity to process and utilise information.¹⁵²

One year later, in 1984, the independent commission for world wide telecommunications development (the Maitland Commission) submitted its report *The Missing Link*. The point of departure for *The Missing Link* is the fact that the

inhabitants of the industrialised world look forward to enjoying the full benefits of the so called "information society" by the end of the century "and "The situation in the developing world is in stark contrast. In a majority of developing countries the telecommunications system is inadequate to sustain essential services. Neither in the name of common humanity nor on grounds of common interest is such a disparity acceptable.¹⁵³

In a very short time the focus in many industrialised countries had shifted from the slow and dreary administration of long queues of potential subscribers to the image of the "information society" and the necessity for rapid changes. Both the industrialised countries and the developing countries tried to catch the fast moving train before it was too late. In fact, the two-faced Janus of being both late and at the same time in the forefront of high tech development was often transmitted in popular magazine articles, in the newspapers and, of course, in television programs.

I will explore the meeting between visions and "reality" through four attempts to test new telecommunication technology, especially for rural development. The attempts to test new telecommunication technology are usually part of a larger policy context. For a closer description of the more overall policy of Norway and Bénin see appendix 2 and 3. The next part of this chapter will present some of the policy documents, as these give an important background for the proposed "social experiments".

Framing Technology

Policy papers are the result of a long process of negotiation and thereby translation. However, they are finally presented as a common framework for action. The strength of this common framework may be undermined in the text by clues pointing to ambiguity, inconsistency or outspoken disagreements. The four hybrid communities under study here are supported by three policy documents that have several traits in common:

- 1) They assume that the implementation of information technology and/or telecommunication technology is an important part of economic growth,
- 2) They reject dualistic economic growth,
- 3) They propose policy-measurements to even out disparities occurring in implementation and development.

In this perspective it will be of interest to see how the policy papers try to ensure co-operation between users, producers and the technology. Since my perspective is mainly focused on the relationship between telecommunication technology and rural development I will limit myself to this when discussing the path from policy documents to the proposal of tests.

The Telematic Report: We Need Field Trials to Enrol the Actors and Test Technology

Translated into the policy text of the Telematic Report one finds elements from the scenarios submitted to the Commission. The six scenarios represent two rather traditional images - the images of Utopia and Dystopia. In Utopia the good life is in the rural surroundings: imaginative and creative forces are important and represented in the scenarios by children and the populace: social and intellectual life is improved by modern technology since our rural environment is our living place, not necessarily our workplace. We are actors in an enhanced "room" for action, and the cities are nice places to visit but not for living. In Utopia priority is on "small is beautiful" and the machines as our servants. The improvement of skills is a constantly ongoing process. In Dystopia the good life is "nowhere", geographically speaking, and the rural areas are linked to the cities by a geographical division of work - unskilled

work in rural areas and skilled work in the cities. The industry is dominated by large integrated companies, with highly specialised activities. The elite is in power and the unimaginative and passive attitudes of parents and the populace make this possible. Our privacy is intruded on by surveillance and the integration of information. The machines are our masters.

The policy text takes as its starting point the following axiom: "The ability of telematics to reduce the importance of distances will be an advantage for the districts". The sometimes enormous hindrance that distance may represent is then transformed into a minor one by the help of telematics.¹⁵⁴ The problem of distance is thereby delegated to telematics. By this delegation or translation the authors have so far solved the problem. This argument is further strengthened by emphasizing that 1) decentralised industry will experience that the privileges of central location will soon be eliminated, 2) it will be cheaper to relocate businesses to other places and 3) the computers will become both more powerful and cheaper. Seen from the cities, it will now be possible to avoid congestion by relocating industry in the periphery, and by relocation housing will be cheaper, the work force more stable, etc. However, and at this stage the dilemma is introduced, new technology may also be used by the centre to control industry in the periphery. Overcoming geographical barriers to be sure: but whether delegation or centralisation of control will happen the author cannot really tell for sure.

In a policy document it would have been difficult to stop with such an ambivalence and it is therefore stated that the possibilities for positive effects are the most likely. One has many possibilities for the decentralisation of jobs and the introduction concludes by stating that: "telematics are opening up for an extensive use of so-called telework". However, in the text they problematise the concept of "telework", since according to the definition used it can imply both "work at home" and "work in a neighbourhood centre". The commission emphasizes several important aspects of telework and then states that there has been no research on telework in Norway. Furthermore, as telework may also be performed from private homes the Commission discusses whether this is really desirable.

First of all one has no colleagues at home. Secondly, the laws regulating working conditions do not apply at home. The Commission then states that "It has been argued that telework will employ especially women on a part-

time basis, while the men in full-time jobs will supervise the activity. It is therefore important to prevent telework from being part-time homework in connection with child-care, etc.". Emphasizing these arguments, the Commission does not expect homework to be interesting. The argument then shifts to a more positive tone, stating that field trials with neighbourhood centres have been conducted in Sweden (Nykvarn). There have been some problems with the financial side and some organisational problems, but the Commission has reason to believe that these problems will be overcome. They then state that a telematic centre (neighbourhood centre) is to be a local data/-communication centre including for instance:

- employment opportunities
- instruction/education opportunities
- local television/conference studios
- entertainment opportunities
- opportunities for the public to use teleservices not available at home

Telematic centres (at this stage in the text the neighbourhood centre is "transformed" into a telematic centre) can be located throughout the country and be an important measure in both district and employment policy. The telematic centre should be a joint venture between industry, public authorities, private organisations and interested individuals. The final sentence states that: "The Tele Commission recommends that municipalities and/or interested firms start field trials with telematic centres".

In the policy document there is both a strong and a weak program, the strong program being the program with all the problematic possibilities. In this program we find the market forces and all the negative prospects for rural society. It is important not to strengthen this program. On the other hand one has the weak program with the "reconstructed" rural society and all the constructive possibilities. To strengthen the weak program the Tele Commission concentrate their recommendation here.

In the arguments outlined above there is a symmetry between what I have called problematic possibilities and constructive possibilities. This symmetry does not apply, however, to the policy recommendation. In the policy recommendation the constructive possibilities are recommended for field trials, but not the problematic possibilities (See figure 8).

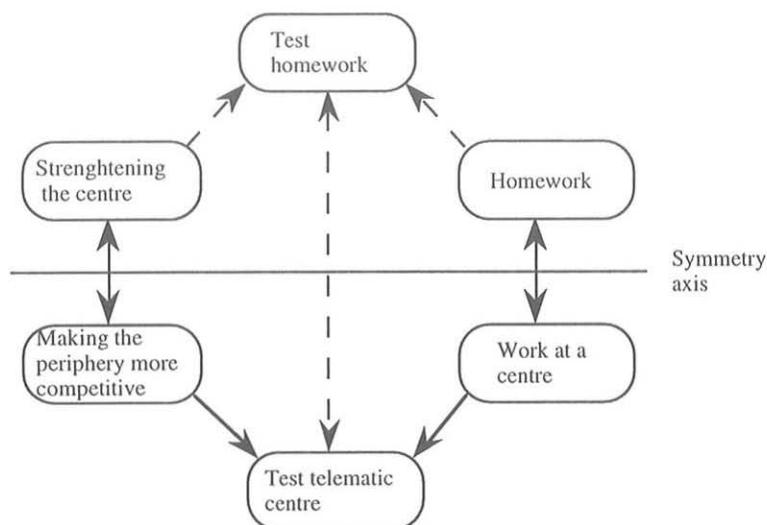


Figure 8 The framing of telecommunication testing

On the constructive side one finds the possibilities, if stimulated, that will make the periphery more competitive. The interesting one in this context is work at a centre. The constructive possibilities lead to a policy suggestion: test telematic centres. On the problematic side one finds the possibilities which, if stimulated, will make the periphery less competitive. The interesting one in this context is homework. To explore these problematic possibilities the following policy suggestion could be relevant: test homework. However, this was not done: in spite of the fact that the problematic version is a social construction heavily relying on the assumed linkage between a set of values and a specific application.

Bloor established the principle of symmetry, the demand that true and false beliefs should be analysed in the same terms.¹⁵⁵ Callon extended this principle, and in a later article he states that the social, the technical, and the objects in the natural world should be analysed in the same terms.¹⁵⁶ If we extend the arguments of Callon it will of course also be necessary to investigate

the problematic possibilities. Is the linkage between a set of values and a specific application a very solid linkage? By limiting the investigation to the presumed linkage between values and a specific application one is also limiting the research agenda. *The technical possibilities are therefore limited to specific perceptions about distinctions and relations between the social, the technical, and the cultural.*

While the first report argues for the necessity of field trials, the next report take the field trials for granted and tries to enrol possible actors.

The Blegen Report: Enrol Possible Actors and Make Equipment and Network Available in an Experiment

Not only in the Norwegian Tele Commission report but also in the Blegen Report the problems are perceived within the framework of the rural-urban dichotomies of a dualistic society - the rural areas potentially the "information technology poor" while the urban areas potentially the "information technology rich". On the background of this "coming" dualism: "This document is founded on the recognition that an enhanced information technology richness is the pillar of economic growth, and the present project shall ensure that this pillar also embrace the sparsely populated areas".¹⁵⁷

In August 1987, the Norwegian Government decided to participate in a large scale experiment with Norsk Data, at that time the main producer of computer equipment in Norway. According to the minister of industry, Finn Kristensen, and the minister of local government, William Engeseth, this project "would be an important contribution to the development of local industry and the districts. The project will link the least developed part of Norway closer to national centres of excellence". However, "The machines are going to be placed in local centres of excellence where it is possible to mobilise people and resources, and thereby develop interesting future oriented projects where the possibilities in computer technology and telematics are used to the best for the whole region. Close contact with institutions for higher education will be important for speeding up the diffusion process".

"People with competence will not return to districts without computer technology and networks, and without competence there will be no understanding of the need for computer technology and networks". The writers

of the report claim that it is necessary to destroy this vicious circle or as they state "this vicious circle is the reason why we now have a public will to cut the (Gordian) knot". "Therefore we consider the proposed establishment of local centres of excellence as a (policy) experiment. We know of no other program in Norway or in any other country that has tried something similar. The closest may be the IT-measures taken in France and Canada. *The experience from these experiments is positive.* We believe that for the proposed 4-year period we will experience an enhanced IT-richness in the districts and that this will be an indicator for new and meaningful growth in district-Norway". (My own italics)

As both the technology and the main actors are enrolled in this initial phase the challenge is perceived to be the enrolment of local users and competence. To ensure this, the research council (NTNF) asked all the counties and other interested parties to submit suggestions for possible participants. The result was 51 proposals. How then to choose among 51 proposals when only 10-15 could be selected? The negotiation and translation process that are presented in the rest of the report have resulted in a detailed description of 19 of the applicants. Each applicant has tried to enrol local and national competence, creating strategic alliances often in the form of business ideas. The final decision was later made by the government since they had to make exceptions from the rule to enrol some centres that did not fit into the model of "districts".¹⁵⁸

While the second report focuses on the selection of possible actors for the proposed tests, the last report tries to enrol the decision makers in the promotion of solutions.

The Missing Link Report: Enrol the Users and Demonstrate their Needs to Producers and Governments

While "modernity" was considered to be an ambiguous concept in the scenarios submitted to the Norwegian Tele Commission, the modernity of the industrialised countries is perceived as something desirable in documents such as The Missing Link. The Missing Link is therefore not founded on the necessity of penetrating an unknown future, but rather on closing the gap between the developing countries and the industrialised countries. The

following dichotomy is therefore essential: "It cannot be right that in the later part of the twentieth century a minority of the human race should enjoy the benefits of the new technology while a majority live in comparative isolation".¹⁵⁹ In the Missing Link Report the discussion of relevant social groups include the total population of the earth and the document advocates the necessity of closing the growing gap. This report does not start with the prospects for the future, but with some "random examples" of emergency:

A civil servant whose Minister has to make an urgent announcement in the capital needs a crucial statistic from the provincial centre.

A banker needs to confirm a customer's credit-rating to gain him a contract whose deadline is about to expire.

A health worker on an island devastated by typhoon wants to know whether urgently needed medicine will arrive for an outbreak of cholera.

A farmer needs advice on combatting a fungus which is destroying his crop.

The manager of a cannery wonders when the next consignment of fresh fruit will arrive from the interior.

A rural co-operative wants to know what price it will get for its beans in the capital.

A mother worries about her son who has left the village in search of work in the city.

A villager needs urgent information on farming equipment.

All these people need information. Without rapid and effective communications they will have to wait for days or travel themselves to get an answer. In many cases they will have to do without the information they require. The result could be waste, inefficiency, even tragedy.¹⁶⁰

By this enrolment of different relevant social groups and their needs the Maitland Commission tries to demonstrate the moral commitment among the audience addressed. The audience is the "international society" in which the International Telecommunication Union (ITU) intends to play an important mediating role.

After the submission of *The Missing Link*, ITU launched the First World Telecommunications Development Conference in Arusha, Tanzania in 1985. This conference agreed on the Arusha Declaration on World Telecommunication Development stating that the principal objective should be: "... by the early part of the next century, virtually the whole of mankind should be brought within easy reach of a telephone and in due course, the other services telecommunications can provide...".¹⁶¹

If we look at Norwegian telecommunication development, as late as in 1957 the politicians referred to the lack of private telephones as "a luxury misery" in relation to those who lacked a job or a house. The number of applications tripled from 1970 to 1979 and in 1979 we find 123.000 on the waiting list for a private telephone. During the next five years heavy investments managed to get rid of the queues.¹⁶² In the developing countries one now perceives the common use of telephones as an intermediate strategy to bring the whole of mankind into easy reach of telecommunication services.

Several development agencies have adopted some of these perspectives, among them is The International Association of Community Tele Service Centres (IACTSC). This organisation combined the visions set out by the Maitland Commission with the experience from the Scandinavian countries with telecottages, telehouses, telematic centres, etc., but gave the "social invention" a more general name: Community Tele Service Centres. The idea was to reduce the cost barrier and to contribute to the fulfilment of "*The Missing Link's*" objectives. To disseminate the idea of Community Tele Service Centres, IACTSC has promoted experiments in both Bénin and Brazil.

Even if the three documents have some traits in common, they may also be perceived quite differently. The first document, the Telematic Report, is confident that the new technology will benefit "somebody", but unsure who and how the new technology will benefit. The second document, the Blegen Report, tries to promote a certain solution in an attempt to benefit the marginal regions or districts. However, they are still unsure about how the new

technology will benefit. The third report, The Missing Link Report, knows both who and how they will benefit with new technology. However, they are searching for the best strategy to implement the solution and to meet the anticipated need and demand.

In the next four chapters I will present the hybrid communities that were created to accomplish, among other things, the aims of the reports discussed here.

5. The Explorative Experiment

Defining the Role of the Hybrid Community

According to the diffusion of innovation model, hybrid communities at their most explorative stage tell us about the social relations of information and communication technology in general; or at least about the relevance of particular applications to potential user communities. By this the implications of information and communication technology can be assessed and incorporated into forecasting and development efforts. I will therefore begin with the case of testing a more or less "unknown" range of technological possibilities. The case study chosen is a pioneering test by Telenor, testing out a variety of possibilities in the municipality of Jevnaker, also called the Telematic Sandbox. In this first case study, I will present and elaborate on how different actor-networks are constituted for the inscription of both technology and tests. Furthermore, I introduce the problem of double framing by producer- or user-driven actor-network groups. How are different user-values enrolled in the process of hybridisation?

In the Telematic Sandbox, the actors originally outlining the experiment defined it mostly as a experiment with new fibre optic cables that should allow for the transmission of cable-TV and similar "broad-band" services, or as Collett and Lossius write:

The local community of Jevnaker was chosen for the test of a long range of anticipated services in the coming telematic network. The basic service in the community was the advanced cable TV-network to the individual users in combination with a fibre optic network to local industry and public institutions. One of the services tested was local TV and radio production. However, the intention was that Jevnaker should serve as a laboratory for the development and testing of professional services for households and industry in co-operation with local users. The laboratory model was chosen for the test of new services since the new services considered needed quite a different infrastructure than the telephone.¹⁶³

The project started in late 1982 and was prompted by three major considerations. First, that Telenor experienced a fast growing number of private cable-TV networks, and Telenor wanted to participate in this market. Secondly, in this first period Norway had a more liberal policy towards private TV and radio transmissions, primarily on the local level. Finally, Telenor expected that the private cable-TV networks and Telenor would perhaps be competing service providers in the future, and envisaged a possible merger between the two networks.¹⁶⁴

The aim of the experiment was therefore to carry out tests with new technology; some of the most novel technology being the fibre optic cables. But also to test and develop new skills among Telenor's own employees. Even more important was to test different new services and to enlarge the market for telecommunication services (preferably broadband services). A rather complex experimental situation developed, in which Telenor aimed at enrolling both new technologies in their core activities, new skills and not least new markets. The new markets was not unimportant since Telenor's own employees faced unemployment as the demand for traditional services became saturated.

However, not only did Telenor try to meet expectations among their own employees, but also the local politicians of Jevnaker had rather specific expectations. First of all they expected an enhancement of the communication possibilities, with both better communications and improvements of local mass media coverage. But even more crucially, the local politicians wanted to promote Jevnaker as a technologically advanced municipality which eventually could attract outsiders and potential entrepreneurs to create new jobs in the community. The local challenge was simply: how is it possible to use new communication technology to promote local development and employment? Even if it was made clear to the local participants and supporters that this was not the main issue for the experimenters, it was nevertheless made very central and later highlighted in media coverage. Mathisen emphasizes that this was not in opposition to Telenor owns' aims, but that these effects had to be side-products of the project.¹⁶⁵

The first part of the network was officially opened on 13 February 1984 and the hybrid community was to develop through 1986. The hybrid community encompassed both technical, strategic and locally defined problems framed by different group of actors. Nevertheless the hybrid

community gave important results for the development and use of telemedicine, distance education, video conferences, fibre optic cables, cable-TV, local TV and radio production, etc. I will, however, concentrate on one more social invention - the Telematic Centre.

Shaping the Test Setting

A mixed industrial and agricultural municipality, Jevnaker has about 6000 inhabitants. Because of its proximity to Oslo, which permits commuting (70 km.), the municipality has increased its population by one fourth since 1960. Two thirds of the population live in the more central areas of the municipality, while one third of the population live in the more sparsely populated areas. The Jevnaker project involved a two-way fibre-optical broad band network for business subscribers, and a one-way broad band network with a narrow band return channel to household subscribers.

The rural areas were given priority by local actors during the experimental period. However, for technical and/or economic reasons only 7% of the farmers were hooked up to the network. The local municipality and the politicians made this problem salient in the search for solutions in the hybrid community. How could that part of the population which live outside the central areas be active participants in the development of new information and communication services?

The driving force was Telenor Research and the main organisation of Telenor, both at the regional and national level. As their allies they tried to enrol different actors, at the first stage on a more formal level in which the actors were expected to act as representatives for different interests. Telenor and the researchers took charge, similar to that promoted in dialogue research, when they negotiated with the local participants. This is reflected in the roles given to the different actors. The project group in Telenor was recruited from both the research institute, the headquarters of Telenor, and the regional and local administrative units. To secure overall control and support of the project group, a steering group was established. As counterparts to the steering group one finds the local administration of Jevnaker, the users, different research

institutions and consultants, manufacturing industry, equipment suppliers and suppliers of services and software.

To handle co-operation between the project group from Telenor and the local administration of Jevnaker and the users, a liaison committee was established. The mission of the liaison group was to look after "...the interests of the local community and be a contact body vis-à-vis the Telecommunications Administration during the development of and experiments with cable television at Jevnaker". The paragraph regarding ultimate authority states that: "The co-operation group is to approve each individual proposal for experiments with new services brought forward by the Telecommunications Administration or others."¹⁶⁶ The latter formulation was to ensure the local community a reasonable measure of control over experimental activities.

The interdefinition of actors was therefore rather formal and mostly designed by the initiators. However, this formal interdefinition did not necessarily reflect the real influence of the different actor groups. Even if the local participants did not advocate very strongly against any of the proposals, the situation was treated as an example of reciprocity that should result in a balance between 1) activities that mostly were interesting for the researchers and 2) activities that mostly were interesting for the local participants. The implementation of the project entailed strategies for the enrolment of both the political authorities and the public administration of the municipality represented among others by the mayor. The users represented by different organisations, subcontracting research and consultancy firms, the industry and technology producers and finally the service and software providers.

By initiating the project Telenor inscribed certain features, intended or unintended. First of all, the project was part of an international setting, often compared with similar projects in other countries. The most frequently mentioned were the Biarritz-project in France and Higashi-Ikoma in Japan. This comparison was flattering for Telenor, but was also a problem since it created expectations both among local and national actors that were difficult to fulfil. The two mentioned projects were, after all, on a larger scale and had both higher and different ambitions. However, it was important to advertise the Norwegian activity, and for this reason the resources available for testing were plentiful.

When the Jevnaker project was formally established, the first persons to sign the guest protocol were the royal family. This "inscription" by the most prominent persons in the country was transmitted in every conceivable media and indicated that Norway was now taking an important step into the future. Communication of images and expectations may later on create problems since communication through the media often results in a translation from "possibilities" to "realities", or "suggestions will quickly be perceived as realities, since they have been printed in the newspaper".¹⁶⁷ The enrolment of both technology and actors continued in the years to come. The Jevnaker project was open to different kinds of participation and therefore a larger group of participants more or less recruited themselves: often through voluntary organisations, mostly to participate in the activity of the local radio and TV station.

When communication technology is put to the test, the strength of the association created between actors and artifacts is crucial for how the need for communication is translated into demand. The interdefinition of actors and the problematisation of their common interest are therefore fundamental. In this respect I will focus on local industry and the experiments especially aimed at this group. As an old industrial community, Jevnaker has an above average percentage of industrial workers. The core of the industrial culture derives from the old glassworks, which started 230 years ago. Together with a smaller glassworks, these two factories employed about 300 persons when the hybrid community was created. Among more "modern" industry, Jevnaker hosted only one other company of a similar size; the rest were small companies with less than 50 employees.

Enrolling Experienced Users

In the fibre optic part of the network the intention was to link about 15 industrial users together in a central exchange which should have the possibility of broad band transmissions. This technology would enable video conferences and picture telephones. The remaining industrial users would be linked to the more traditional coaxial cable with LAN-equipment and this would allow for data communication and distributed switching. Possible services would

be electronic post, telemetry and more well known services. What was special to the network was the return channel of 5-68 MHz. In addition to switched data services, this return channel gave the opportunity for several video channels, or possibly fixed high speed data links.

Most of the tests were planned to be *local*, but there would also be a radio link out of Jevnaker, making possible video conferences and similar services. *However, at the outset of the project no final decision was made about which services should be tested and which services should not be tested. These decisions were to be made in a dialogue with the users.* The decisions for specific experiments were postponed since the network had a high flexibility, and also a high capacity to transport most of the services that could be made relevant.¹⁶⁸ The process of enrolling the local users made it therefore imperative to have better knowledge of their needs.

During the summer of 1984 all the local firms and some public institutions were asked about their interest in participating in the technology testing and their "need" for new telecommunication services. Of 98 identified firms, 39 (including 4 public institutions) said they might be interested and the interest increased with the size of the firm.¹⁶⁹ However, if it is possible to identify a typical firm, it might be an engineering workshop with 26 employees. Four of its employees were in administration, the rest in production. The communication and information budget - post, telephones, advertising and travel - was 2.3% of the total turnover, the telecommunication part about 0.6%. The firm did not have its own computer system, but relied on an accountancy firm in Oslo. This "typical" firm indicate that the potential industrial user was both small and had little experience with new information and communication technology.

The small "need assessment" among the local industry for telecommunication services concluded that one of the most appealing services from the very outset was the possibility of telephone conferences. The three largest companies in the municipality clearly expressed a greater interest in new services than the rest. However, more important for the interest expressed was which kind of info-communicational systems they participated in. From a local perspective 11 of the 35 private firms interested were part of larger companies or chains with head offices outside Jevnaker. Several of these firms had no links to local firms at all - they bought and sold only a small amount

of goods and services in the local community. The implication of this was that their communication links first and foremost were out of Jevnaker, primarily to head office. The 24 more local firms had a limited number of links to the rest of the local industry and the info-communicational network of the local firms in Jevnaker indicated therefore, rather early on, the main problem of the experimental setting.

From local industry's point of view *the problematic communication issue was not embedded in the local possibilities for internal communication in the municipality, but rather the need for communication with the rest of the world.* This communication need was a reflection of how the firms were integrated in the economic system outside Jevnaker. On the other hand the strictly local firms finding most of their market in the community did not express any strong interest in participation in the test, mostly because *"they were too small to find anything of interest to them in the hybrid community"*.

The Interdefinition of Actors

For the outcome of the test in this hybrid community it was important to enrol actors so that they participated in the construction of both facts and artifacts. It was also important to "control" their behaviour in order to make their actions predictable. The first important part of the strategy employed was the translation of interests, i.e. the interpretation given by the fact-builders of their interests and that of the people they enrol.¹⁷⁰ This translation of interests was critical for the construction of a actor-network that would pursue the defined aim of the test. First the experimenters enrolled a local project manager with a strong emphasis on creativity and, at best, the ability to act as a "chaos pilot".¹⁷¹ Later they tried to enrol the community by the construction of different representative committees. By this enrolment they succeeded in creating a positive attitude among leading politicians. However, to enrol actors on a more stable basis one has to tailor the test in such a way that it caters for these actors' explicit interests. The first "need assessment" was therefore an attempt to get a thorough knowledge of the "explicit interests".

The most explicit interest revealed by the "need assessment" was to communicate with business associates, mostly outside the local community.

This interest may be understood as *an interest belonging to the sociogram* as it primarily referred to how different actors and firms related to each other in the economic system. Technologically speaking, the firms referred to, expressed a need for different kinds of "message transmission"-systems. They did not necessarily need to communicate directly with their partners. However, they needed a more efficient system for transmitting messages independent of time and place. This need could be satisfied by different solutions such as cellular telephones, pagers, a manned telephone answering system, etc. However, these expressed needs did not entail the advanced broad band system that was introduced at Jevnaker.

Some possible needs for the full transmission of video pictures were identified, as, for example, video conferences, interactive distance education, the interactive marketing of products and telemedicine diagnostics. Common to these applications were, however, that if they should be of any real use they had to provide communication with partners outside the community of Jevnaker. As it later turned out, this was one of the most difficult aims to achieve, mainly due to internal administrative "problems" in Telenor.¹⁷²

For local industry, communication links reflect their organisation of production and marketing, while the organisation of production and marketing reflects the level of economic integration. In the local community there was, and still is, a large group of family firms, often conducted on a household basis. These small firms relate mostly to the local market and behave fairly *independently* of other firms. This very traditional way of organising economic activity does not promote strong economic integration and, as in agricultural society, these firms often consist of a large number of similar production-units. Only to a very small degree is there any kind of formal integration between the different production units. We find few demands for any kind of formal education or qualifications, and the networks they participate in consist of many "strong" and few "weak" ties.

This implies that much of the communication that is taking place is informal and primarily through network contacts. Since these small household firms managed very well without a very strong formal information system they did not express a strong need for new telecommunication services except for some wireless possibilities; like cellular telephones and pagers. The reason for this "need" was usually found in the fact that they often were craftsmen or

occupied in very "mobile" jobs, and therefore needed contact with home-base.

Only a few local firms were integrated in a form of production involving sub-contracting, etc. in the local community. The most frequent form of "in line"-dependence was therefore found among the firms that were sub-contracting to firms outside the community. Some few local firms had bought up subcontractors, and either established sales offices or co-operated extensively with other companies. Usually this last strategy involved enhanced communication contacts both for the production and marketing departments of the company outside the local community. Most of these firms wanted to rationalise the more routinised communication contacts. Communication services that could be interesting, they said, were well-known services like telephone conferences, telefax, etc. The relationship between the two glassworks were to a certain degree characterised by competition, but mostly these two companies related to each other by defining different niches in the market.

In a later study of info-communicational systems in local industry, Odden found by studying communication by post, telecommunication and travel that ¹⁷³:

- between 41% and 46% took place inside the municipality
- between 24% and 29% out of the municipality and to the surrounding municipalities
- between 14% and 17% out of the municipality and to Oslo
- between 12% and 13% out of the municipality and to the rest of Norway
- between 0% and 1% out of the municipality and to other countries

A more tentative classification based on these results indicates that about 81% of the firms have a predominantly local orientation, while 19% of the firms had a more predominantly external orientation. This should have been interesting facts for the experimenters, since most of the tests aimed at activities taking place inside Jevnaker and between local actors. However, as most of the local firms were rather small, this was a problem. A situation evolved in which the firms that fitted into the *anticipated locality of the experimental setting* apparently were too small to have interesting problems in relation to new communication technology, while the firms that apparently had interesting communication problems did not share these problems with other partners at Jevnaker, but with partners at other places that were not covered by the test!

This paradox was perhaps surprising, but prevented the enrolment of actors into the more advanced part of the anticipated test. Tests were, however, conducted. A test with video telephones was set up at the local health service (delayed by the difficulty of developing the picture telephones). Furthermore, a test with video conferences was established (delayed by transmission problems out of Jevnaker and postponed to the second phase of the project). There was also a test with distance education (also delayed by the difficulty with transmission out of Jevnaker). Later, a test with interactive video was established (this test resulted in a solution that did not need an advanced broad band network for the transmission of the pictures). Finally, the planned tests with high-speed data communication was never implemented since the number of potential users, if any, were too small. Fibre optic cables linked 12 users of the planned 15 industrial users, and this included public institutions. The results of these tests were perhaps important for Telenor, but rather uninteresting for the local community.

Locking Allies into Place - the “Social Invention”

The challenge that Telenor and the municipality faced was the fact that this municipality was rather typical of a large number of municipalities. With the future-oriented visions inscribed into the hybrid community, many actors felt that there *had* to exist some possibilities in new telecommunication technology that could be adapted to the local industry of all these rural and/or remote municipalities.

This strive towards a solution that enabled the more visionary scenarios to become reality led to the birth of the “telematic centre”. Mathisen state in his mid-evaluation report that

The telematic centre was not on the menu of possibilities when the social experiment started. It is therefore an example of how we succeed in catching new ideas during the process, just as we hoped. However, it is more difficult to tell, in retrospect, how this idea developed. The idea had several sources: needs expressed by the users, impressions from similar projects in other countries, experience from similar activities in small communities. The Tele Commission report was also a source of inspiration.¹⁷⁴

The Jevnaker project therefore moved from being a test bed of technical inventions to testing a more "social invention"; the telematic centre. By this move the focus of the test moved from the technogram to the sociogram - *the ability to speed up or enhance local economic development by telecommunications was at stake.*

The Jevnaker project "took off" as an attempt to test the possibilities of a broad band network with the most advanced technology that money could buy. It may therefore be perceived as a paradox that one of the most novel inventions, the telematic centre, only needed an ordinary telecommunication network for most of the proposed services. The telematic centre opened in October 1986 and was a symbol of the next phase of the Telematic Sandbox. Services like sales of telecommunication equipment (and the possibility to lease equipment), teletex (also providing telex communication), telefax, videotex, terminals for on line literature search in different data bases, a technologically advanced conference room, work places with PCs, a copy service, the possibilities for video production, were all included in the manned Jevnaker Telematic Centre.

I will not give a detailed account of how the test developed later; mostly because some of the more practical problems that Jevnaker Telematic Centre faced are more thoroughly discussed in the next case study. Later experiences led to a close down of the Jevnaker Telematic Centre in 1991. However, not necessarily because it was a failure in all respects (even if the profit-and-loss-account was disastrous).¹⁷⁵ Odden concludes that "based on the use of the Telematic Centre it is not likely that it will be a permanent multi-user solution...and, I conclude that the Telematic Centre has greater impact as an agent for the diffusion of information about new services, than as a permanent multi-user solution".¹⁷⁶

Inscribing Technology

If one follows the technology from the very beginning of the Telematic Sandbox to the decision to test the Telematic Centre, one is able to identify a succession of inscriptions. At the very outset, the rather novel technology of fibre optic cables was inscribed in a program for action that finally should lead to the

establishment of a network of communication highways in Norway: putting Norway in the forefront of technology development. This first problem was therefore situated in the technogram. See figure 9.

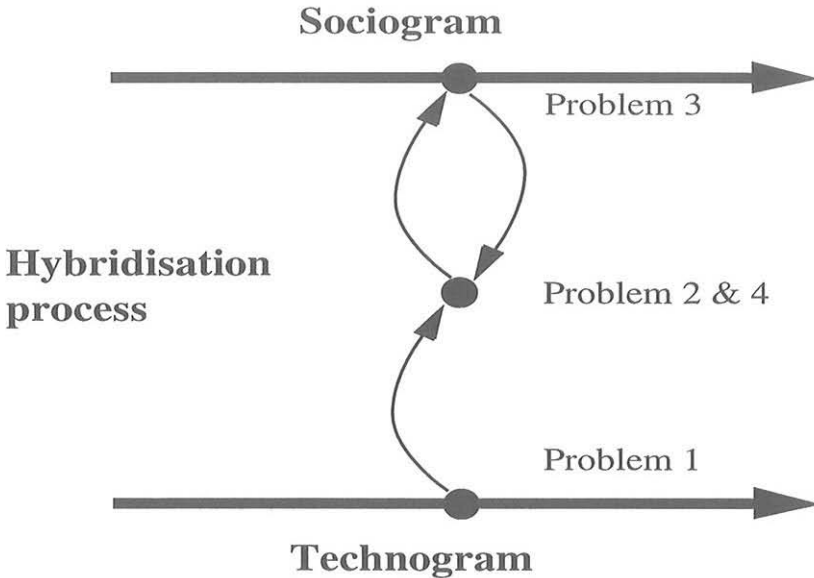


Figure 9 Successive inscriptions in the explorative experiment

However, to enable the use of this technology, the problem was moved to the hybridisation process. What kind of communication problems may be identified and how may these problems be solved by the use of new communication technology? The result of the small “need assessment” revealed the paradox that the most interested firms were not covered by the test setting, while those covered by the test setting found little of interest in the test. This paradox situated the problem in the sociogram. However, to solve this problem one had to inscribe ambitions into the test that were beyond the possibilities of the hybrid community.

The search for a solution led finally to a hybrid: the telematic centre, enabling different users to participate in the “information society” with new communication technology by a multi-user solution. The “social invention” of the telematic centre was thereby a reality. When this invention later “failed”

as a solution in the market, the result of the test could also be interpreted differently. Perhaps, it was not the idea of the telematic centre that was a failure, but the experimental setting of Jevnaker. I will come back to this last interpretation when I discuss the translation of experience from Jevnaker into the pilot experiments.

Inscribing the Test

Not only the technology as such experienced successive inscriptions, but also the test. Originally the strong program of Telenor at Jevnaker was technology testing and the development of new services. However, the different obligations inscribed by the enrolment of local actors later circumscribed the setting quite differently than intended. The double framing of the problem put to test, both in a frame of technology testing and also in a frame of local development should enable the actors to shift out of one frame and shift into the next frame without leaving the overall framework of the expected role of new technology in economic development.

However, the weak program of job creation, skill development and an overall modernisation circumscribed the strong program involving the test of novel technology and thereby limited the hybrid community. One interesting example of this was given in Jevnaker, where I conducted a study among the farmers about their interest in participation in the project. Almost all of the farmers preferred to call the known lead user before they answered the small questionnaire. By such mechanisms the lead users had an important influence both on what should be tested and the outcome of the experiment. This may be one of the reasons why one of the evaluators in the Jevnaker project formulated the ten commandments of Telematics. One of these laws were thought to be: "Do not believe that it is easy to build an organisation around new technology. Among other things, enthusiasts are dangerous"¹⁷⁷.

The strategy of selecting lead users or innovative users to provide input data for the testing of technology has important limitations and von Hippel claims that: "Their insights into new product (and process and services) needs and potential solutions are constrained by their real-world experience. Users

steeped in the present are, thus, unlikely to generate novel product concepts that conflict with the familiar"¹⁷⁸.

However, several lead users played important roles as mediators between the projects and the more sceptical section of the public. The enrolment of technology, and not least the design of new services, was therefore guided by the perceived "usefulness" of the same services in respect to local development. The original program of action, the fibre optic cable, had the potential to transmit large amount of information. However, when nobody subscribed to the necessity of transmitting large amounts of information, the fibre optic cables were meaningless.

The only possible solution to re-inscribe meaning into the fibre optic cables was to invent social situations where large amounts of information were involved. One obvious solution in this respect was the transmission of live pictures, as in distance education; two-way video transmission of meetings; ultra sonic screening at the local doctor with diagnostic assistance from a hospital or simply the transmission of TV-programs. All these activities were conducted to prevent the antiprogram from succeeding. However, it was difficult to ascribe to this renewed program of actions the ability to create new jobs or make the local community more attractive to other entrepreneurs.

Even if the interpretations of the results of the Jevnaker project may differ, I will claim that one important reason for it not being as successful as anticipated by several of the actors, may be ascribed to the fact that the project tried to solve rather incommensurate problems and that the double framing of the problems made it in a certain sense difficult to shift from one frame of reference to another. The possibility of shifting from one frame of reference to another creates fewer limitations than double framing; since double framing easily acts as a double bind. *This double bind entails a confusion between the "hybrid community" and "the reality", and the urge to transfer experience from "the experiment" to "the reality" results in a corruption of both the experiment and the reality.*

When the pilot phase followed the explorative phase, the project makers could utilise experience from Jevnaker. The experience from Jevnaker was, however, interpreted as of limited value for the pilot phase. Our own interpretation of the Jevnaker project at the time did facilitate the understanding that the experience from Jevnaker was less relevant for the

transfer of the telematic centre as a “social invention”. Even if much work was done in the Jevnaker project in order to involve the local population and the local business community, we summarised (at the time) the experiences and thereby some of the reasons for “failure” as follows:

- 1) When the local population itself is not taking the initiative and is not responsible for progress, it is difficult to mobilise local actors in activities in which they do not have clearly defined self-interests.
- 2) The value of the policy implications one can draw from local projects in the context of industrial and regional policy, becomes limited when projected economic activities differ greatly from what one usually can expect in “real” life.¹⁷⁹

Since this reinterpretation was shared with actors in different development bodies the path was paved for the pilot phase of experimentation.

6. The Pilot Experiment

Defining the Role of the Hybrid Community

Hybrid communities can also be pilot projects, raising public and industrial awareness, stimulating debate and opening up for policy-making. Based on experience from Jevnaker, it was therefore intended to establish pilot experiments to explore under different circumstances the use of telematics in a context of rural and regional policy, with *policy-making as its ultimate aim*. In which areas would it be most effective to introduce measures to promote local development and raise the skill level with telematics? The Ministry of Local Government, Telenor Research and the Norwegian Research Council had taken an interest in the problem, and launched a policy experiment for a period of 2.5 years which would include four different pilot experiments.

In this second case study the experimenters try to enrol the market in the hybrid communities. But, in so doing, they also take on board the problems of different "relevant social groups" and the contractual relations between actors in networks. The case study therefore reveals both how different relevant social groups are identified and the problem of transaction costs between actors. How are the solutions to the transaction cost problem translated into more formative processes of the test?

When the policy experiment was made known through a five minutes TV-news strip at the prime hour of Saturday evening December 1985, 25-30 municipalities not only volunteered, but argued extensively why they should be selected to participate in the experiment. Originally, four local pilot experiments were selected to represent municipalities with different industrial bases, labour market connections and levels of population growth. The policy experiment that took on board the four pilot experiments was planned to last from the summer of 1986 until the end of 1988.

Later, the Regional Development Fund took an interest in the pilot experiments; partly because many of the municipalities that were not included in the policy experiment still argued for public support. The common denominator for the promotion of new projects was *telework*, and the Regional

Development Fund found it difficult to support these projects without knowing more about the possibilities and limitations of telework. To secure better information, the Regional Development Fund later initiated a more specialised policy experiment mainly concerned with telework.¹⁸⁰ In this telework experiment, which lasted from the fall of 1987 until the spring of 1989, four new communities were added to the four already participating in the original policy experiment.

A whole range of actors and technology participated in the process and the communication situation involved the enrolment of technologies and support, the claiming of competence, the creation of markets and not least, creating and sustaining confidence in the projects. To ensure the necessary input in the policy process, a steering committee was established for the original policy experiment with representatives from the different participators; including the local pilot experiments, development agencies, the regional Telenor administration, Telenor Research, the Ministry of Local Government and the Rogaland Research Institute. The representative from the Ministry of Local Government headed the group. Later, the group co-operated on a more formal basis with the Regional Development Fund as they supported the pilot experiments, and especially facilitated the test of telework.

As social scientists we were asked to give priority to and to evaluate the following four factors:

- 1) The relation between geographical distance and the use of telecommunications¹⁸¹
- 2) The policy authorities were not interested in a new document clarifying the role of the individual. What were the important areas for policy?
- 3) How should the policy for introducing new telecommunication technology be formulated, how should the mix between "technology-push" and "demand-pull" be balanced?
- 4) As policy authorities, they were both interested in an evaluation of different organisational forms for technology diffusion and job creation with new telecommunication technology.

The local participants had their own ideas concerning the pilot experiments. For them the success criteria were to be found in the marketplace, so the technology was perceived as only a means to an end. Since success was to be made in the market they also tried to facilitate this success by their recruitment of participants and the marketing of the projects. The marketing of projects

was important for two reasons: both to ensure the economic success of the projects, but also to ensure local political support.

Shaping the First Test Setting

Translating the experience from the first testing period of the Telematic Centre at Jevnaker also entailed a translation of the concept "Telematic Centre". The reinterpreted Telematic Centre, now called a Telecottage¹⁸², would symbolise the transition that took place when the "social invention" was moved to more rural and remote communities. The image of the Telecottage as a path to the communality of the global village was frequently used in media presentations. The concept was therefore a symbol of the social expectations attached to the later experiments.

The four municipalities of Gjesdal, Forsand, Hamarøy and Vardø were selected for the pilot experiments. In addition to the experiments in these four municipalities, similar projects were undertaken in other municipalities, and Dyrøy, Dovre, Smøla and Jevnaker¹⁸³ were included in the later test of telework.

The municipality of Gjesdal is located within an acceptable commuting distance from the urban area of Stavanger/Sandnes. This means that Gjesdal belongs to one of the five *central* labour markets in Norway. The other municipalities of Forsand, Hamarøy and Vardø are outside what is defined as acceptable commuting distance to a larger city or town, and constitute therefore typical *local* labour markets.

The pilot experiments had inscribed in the test setting certain important features from the very beginning. First of all it was considered important to test the possibilities for telework. This was, *inter alia*, one important reason for selecting municipalities with different distances to different labour markets. Not least, this was the reason why the Ministry of Local Government selected two municipalities in Northern Norway. The problems of the labour market in Northern Norway were expected to grow as the fishing industry and agriculture decreased in importance. However, it was also important to test different organisational and economic aspects of the "social invention" called

telecottages. Important features that were given "priority"¹⁸⁴ by the steering committee were:

1. market relations and networking
2. the telecottage as service provider in the local community
3. the economic basis for the telecottage and internal competence
4. special activities at the different pilot experiments; as service providers for public institutions (Forsand and Vardø), co-operation with local small industry (Forsand), alarm services (Hamarøy) and shared office space (Gjesdal).

However, all the expectations inscribed in the test make it necessary to concentrate on one of the more dominant issues. I have selected the testing of telework as telework was perceived as perhaps the most integrating test issue. I will therefore first give a short presentation of the four municipalities in this respect.

Gjesdal has had strong population growth, and the municipality counts over 7000 inhabitants. This growth stems principally from its "suburban" function to the urban area of Stavanger/Sandnes. This also gives the municipality a central position in relation to a national labour market with a distance of 32 km from the municipal centre to the downtown centre in Stavanger. Gjesdal has not had a corresponding increase in the number of local jobs, which has created a growing "commuting problem" out of Gjesdal.

With about 1000 inhabitants *Forsand* is the smallest of these four municipalities. In order to reach Stavanger/Sandnes, it is necessary to travel by ferry and the ferry connection makes it cumbersome to commute daily. Among other things this resulted in a population decrease for some years and it was therefore considered important to create local employment which could appear attractive to young people with education. Population growth today is more positive.

Hamarøy is located in Northern Norway, just inside the Polar Circle and has close to 2300 inhabitants. In the last 30 years Hamarøy has lost about one fourth of its population. The municipality consists of several islands and is characterised by a traditional combination of agriculture and fishing. In addition, we find some fish farming and light industry.

Vardø has today just over 3000 inhabitants and is, like Hamarøy, among the municipalities in Northern Norway that have in the last 30 years lost about one fourth of their population.

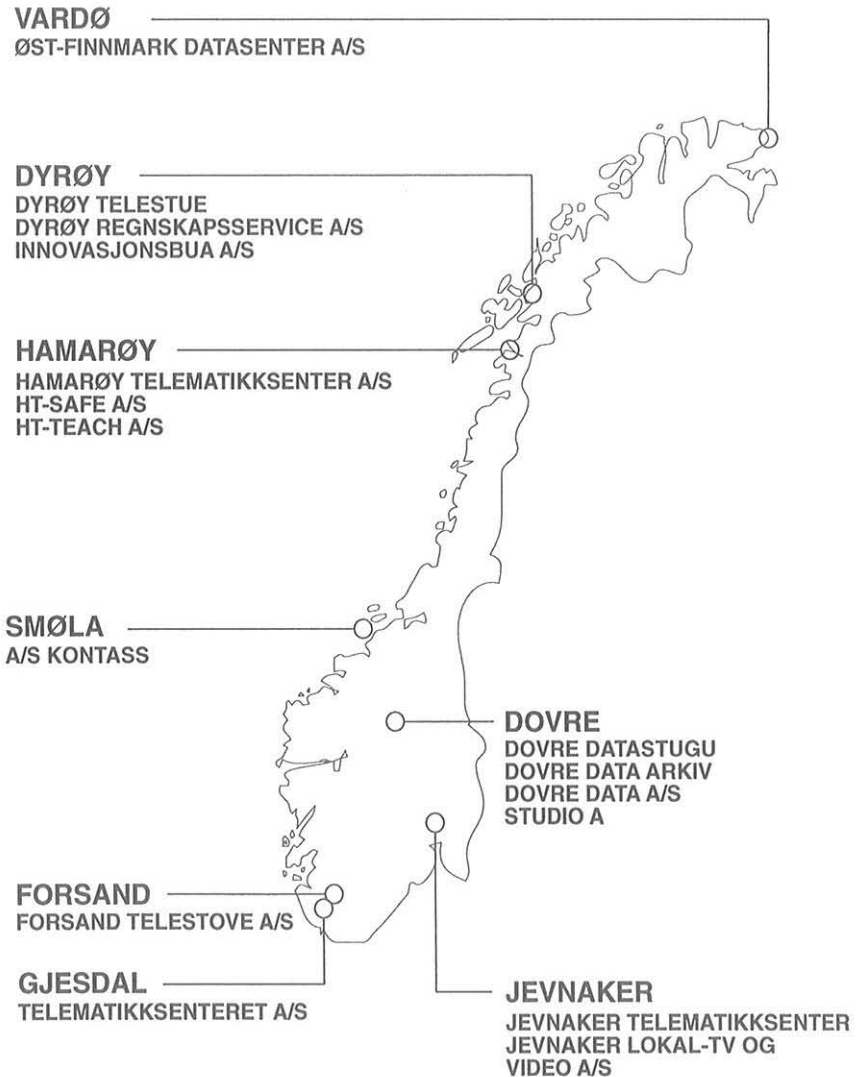


Figure 10 Map of the Telecottages

For Vardø the entire economic base is built upon fishing and fishing industry as the municipality is located on the north-eastern-most part of Norway, on

the edge of the Arctic zone. The small town of Vardø has through history been one of the gateways to the Barents Sea, with close relations to the Kola Peninsula. The project in Vardø was from the municipal point of view only a continuation of an earlier project with telework. In 1984 a small employment project was set up to experiment with telework. The customer in this early project was the University of Oslo, which also initiated the project. However, the project never departed from this very closed group of actors and ended by handing over their people and equipment to the later telecottage. The telecottage was established in 1986, organised as a private firm with dominant municipal ownership and was called the Eastern-Finnmark Computer Centre.

The Enrolment of Allies

The four pilot experiments were part of a more general policy experiment, and, in this, actors on different levels participated. At the national level: the technology producers and service providers, policy authorities and the research institutions. At the local level: the local politicians and the initiators. Finally, at the level of the pilot experiment: the project managers and different local participants. This complex set of actors also results in changing roles for the so-called "users" and "producers", and finally in a hierarchy of spokespersons. The participants in the four different local projects did not have a common arena for planning and rehearsal, and when the telecottage projects grew numerous the different Norwegian projects made contacts with projects in the other Nordic countries. They established the Nordic Association for Community Tele-Service Centres (FILIN)¹⁸⁵ and many of the commercial ideas that developed later, were based on these contacts.

In "The sources of innovations" Eric von Hippel¹⁸⁶ claims that in important categories of innovation it is the product user, not the product manufacturer, who recognises the need, solves the problem through an invention, builds a prototype, and proves the prototype's value in use. His rather counterintuitive claim may seem provoking in the context of product manufacturing, but in the context of services seems more likely. However, the project makers responsible for the pilot experiments did not surrender this process to fate but tried to staff the projects so that this might happen. The projects succeeded

in recruiting skilled and competent persons with entrepreneurial abilities or, as they stated, "gründers" with experience of rural Norway, and with important contacts in the market. This experience was considered very important by the local project makers since the success of the projects in their view was measured by the creation of new jobs and new economic activities.

To promote telework in particular, and the idea of the telecottage in general, it was considered especially important to have a spokesperson that had a strategic network of both potentials allies and market contacts at his or her disposal. By this recruitment-strategy the project makers wanted to imbue the test with success - as "nothing succeeds like former successes". This was especially apparent in the two pilot experiments in Northern Norway. When they hired a project manager they looked for a person with a considerable data competence combined with a spirit of enterprise and, if possible, with contacts in the market. As far as high data competence and entrepreneurial qualities were concerned, interested applicants did actually apply.

In Hamarøy they did hire a person from the outside with both these qualities. In Vardø the same qualities were considered important, and they hired a person who had lived in the community for 18 years. However, he did not have the same kind of market contacts as the project manager in Hamarøy. The initiating group in Forsand had similar expectations and hired a young woman with qualifications in management and computer science. However, she was too young to have the same type of network as the two in Northern Norway. This was, however, compensated in the project plan by making a stronger association of actors around the project manager.

Support from politicians, bureaucrats, possible competitors, and of course from the general public was perceived as important for several reasons. First of all the pilot experiments depended heavily on public money in this early phase and any cut in the subsidies jeopardised the project. Secondly this support was dependent on the ability to "predict" success and to make this "predicted" success visible. Three measures were taken to ensure the necessary visibility.

The most important of these measures was to keep a high profile in the mass media by enrolling politicians, bureaucrats and of course the technology in newspaper text and pictures, and if possible also in the electronic media.¹⁸⁷

By this the politicians had to commit themselves to the basic ideas of the pilot experiments.

Secondly, the pilot experiments tried to arrange open days and courses in which they invited schools, organisations and the general public to participate. By this it was hoped that a lot of people would get experience with the technology and be encouraged to use the centre.

Finally the pilot experiments actively recruited innovative users or lead users. As discussed earlier, the strategy of selecting lead users or innovative users to provide input data for the testing of technology has important limitations. However, these innovative users together with examples from other places should illustrate the possibilities and the fact that the technology was both feasible and had interesting possibilities for different relevant social groups.

To visualise the future possibilities the pilot experiments relied heavily on experience from other places. In fact this enrolment was used rather systematically and the different pilot experiments referred to each other to visualise success. *By this they acted as an inter-referential group of actors, each actor using the others for the documentation of possible (and likely) success.*

The enrolment of participants in tests is crucial to the evaluation of the final outcome and a wide range of actors with quite different abilities may be the result. In several of the pilot experiments efforts were made to enrol actors through local leaders. As "intruders", project-makers and researcher are obliged to undertake this kind of enrolment. They often choose a selection strategy depending on formal leadership. By this strategy the persons recruited to the test settings reflected the position of the local leaders and the local leaders' perception of what was really going on.

In one of the pilot experiments, Gjesdal, the initiators were very concerned about the importance of using formal channels. This concern reflected the flat structure very often used in local development work: everybody is welcome to participate and by definition nobody should be excluded. However, this attitude also entails a very "formal" definition of the test setting, belonging to the frame of politicians and local leaders. *They are usually not risk seekers and usually adopt projects only when a positive outcome is perceived easy to predict.* In Gjesdal this led the municipality board and not the least the mayor, who was the chairman of the initiating group, to define the success in a market context.

It was therefore important to enrol actors who had the necessary market contacts. The assessment and credibility of the pilot experiment were to be decided in the local market for share holding capital. In their written presentation of the pilot experiment, seven persons constituted the interim board, all of them representing different commercial or political institutions, so as to legitimate the pilot experiment. However, in the budget-proposal, only very well-known technology is enrolled, technology that may have been perceived as leading to competing activities by other local firms.

Another important criterion for the recruitment of participants to the pilot experiments was network competence. Network contacts were considered crucial to the success of the pilot experiments and it was therefore important to enrol actors with the necessary network contacts. Different categories of networks were enrolled, the most important being: 1) "Strong" local networks, 2) "strong" professional networks, 3) "strong" market networks, but also 4) "weak" networks.

Strong local networks were typical of the persons enrolled in the first phase of experimental activity, very often before the pilot experiments had really started. These groups of actors belonged to the initiating group, their network were often a kind of power base, important for the construction of the pilot experiments and the necessary "selling in". Selling in is an important activity in the first phase when the local support is a necessary basis for a more active "selling out" later. To enrol national support and money, the national authorities put emphasis on the fact that the pilot experiment had local support. It is difficult to get national support for a pilot experiment with no local support.

The actors with strong local networks formed alliances with actors with strong professional networks, either in public administration or in research and development. These actors were enrolled both because they were perceived as important to the quality of the pilot experiment, but even more importantly to facilitate national support and thereby funding.

Later, when the pilot experiment was in operation, strong market networks were considered important in order to capture the necessary market share. Market networks were enrolled by two different strategies; 1) By enrolling persons with an already established market network to leading positions and 2) by enrolling potential competitors. As mentioned earlier, all the pilot

experiments tried to enrol managers with a combination of strong professional and strong market networks.

One important aim was to create new jobs in the community. It was therefore important not simply to increase local competition, but really to create something new. Three strategies were therefore employed to avoid or to enrol competitors. The first strategy was of course to delimit the activity in the pilot experiment from already existing activities in the local community. In Vardø this was perceived as especially important since the local mayor also had a small accountancy firm and had plans to introduce some computer services in the future. The second strategy was to enrol potential local competitors. This strategy had several advantages. First of all, some market successes could be perceived as part of the pilot experiment already at the very beginning. Secondly their competencies were available to the pilot experiment on a broader basis and, thirdly, the energy could be used for other activities than local competition. The last strategy was to enrol regional or national competitors, either by participating in their network in the development and marketing of services or by selling the final products as a part of their service. Several attempts at this kind of enrolment may be identified in all the four pilot experiments.

Competence and skills were among the important criteria for enrolment. However, what are competence and skills in this respect? There seem to have been several views on this, and several strategies were employed. First we have the dimension of formal or informal competence and skills. Remote municipalities have disappointing experience with the recruitment of persons with more formal competence, for several reasons. Formal competence is often linked to the fact that its holder is not from the community. By recruiting persons with primarily formal competence the remote municipality acts as a "take-off" for young professionals with very little practical experience. When they have acquired the necessary experience they move on to better opportunities.

Formal competence is, therefore, often linked to some very undesirable results. For this reason, employers in remote regions often prefer to hire local people who have acquired the necessary skills through vocational training or simply have taught themselves. Where possible, promising people were sent on courses or received vocational training to acquire the necessary skills. This

occurred in several of the pilot experiments and some people were also given grants for this kind of retraining.

As all the participants actively engaged in the construction of the experiments knew, the success of these pilot experiments was decided in the marketplace. However, the marketplace for this kind of services was perceived as different to the usual marketplace for standard products. The services were to be sold and marketed by the acquirement of confidence in the market, and this type of confidence was only possible to acquire through personal contacts. If a possible participant therefore had a market network in a relevant field of activity it was perceived as an important asset. At the opposite end of the scale one find the persons recruited "because" they had very weak networks. This recruitment was based on a different logic.

Typical for pilot experiments involved in the exploration of possibilities is the "soft" or "weak" framing of the setting. In this weak framing the actor-network have more to say when it comes to the definition of frames, which imply that the framing is open for negotiation. However, this kind of weak framing is often preferred for the solution of quite different problems than the use of technology. Two of the pilot experiments described in this study and also several of the contemporary pilot experiments were framed by the recruitment of participants, which were recruited for quite other reasons than technology testing. One of the main aims of this recruitment was to solve problems such as unemployment among young people or women, or to prevent unemployment among workers from the old manual telephone exchanges.

These participants introduced a quite different perspective into the test with usually no specific knowledge of technology and also marginal knowledge of the market. Even more important, it was difficult to enrol them as enthusiastic participants, employing their energy and creativity for the success of the pilot experiment. Many of the participants viewed the pilot experiment as just another employment project, that would last for some time, but sooner or later would be replaced by another employment project. *They were therefore not fully aware of the fact that they participated in a pilot experiment.*

Finally, apart from the very active recruitment of participants by the initiating groups or project managers, some participants recruited themselves. This recruitment involved some interesting examples of very creative persons with lots of ideas only waiting for a opportunity to be realised. In their own

more global framework they saw a more local framework suddenly created, that could include possibilities for themselves to acquire a more local arena for their own interests. Typically, these are people with experience in several fields, often entrepreneurial people who could, if included, provide enthusiasm and a lot of work for free. One problem with the recruitment of this type of participants is their eagerness to promote their own ideas, without considering the overall aim of the pilot experiments.

The participants and project makers, or the inner core of the actor-network, related to the group of national actors by creating their own organisation - FILIN. FILIN was important in several respects. First of all it gave the participants a better platform to handle both different actor groups and the technology, since the organisation made it possible to discuss alternative strategies. Since the testing of technology took place in the market it was a rather transparent, open situation, with many interested onlookers, and also a strong reason for shaping the outcome. The outcome of the testing in the market would certainly influence credibility and confidence, and by that also the future prospects of the pilot experiments. FILIN therefore acted as an important arena for translation and reinterpretation of experience, and a place to plan new activities and to make small pre-tests. One of these pre-tests was sponsored by the Nordic Council, and was carried out among nine different Telecottages in the Nordic countries. The technology they were using was the Norwegian videotex system at that time, Teledata, which leads me to the enrolment of "mute" allies - the technological artifacts.

So far in this chapter the technological artifacts have played a modest role. If one reads how the pilot experiments were presented in promotion documents and media contacts the picture is quite different. A systematic study of newspaper coverage from the 2.5 year period of the policy experiment covered 78 articles on the subject. In addition to these articles, the experiments are referred to in more general articles discussing development strategies, etc. Among the specific articles, 97,4% have technological concepts in their headlines. Furthermore, 47 of the articles are illustrated, and among the pictures 59,6% portray technological artifacts: the actors are either using the artifacts or they direct our attention to the artifacts. It may be argued that this media coverage reflects the journalists' view of the pilot experiments.

However, I will claim that the media coverage is largely the intended result of a calculated strategy from the actor-group supporting the pilot experiments.

The high visibility and the profile of technology portrayed to the public reflect perhaps one the most important uses of technology in the pilot experiments. In the translation model the negotiations take part between interests defined on the one hand in the sociogram ('outside' recruitment of interests), and on the other hand in the technogram ('inside' recruitment of new allies). *The most important role of the inside recruitment of technology was to ensure and stabilise the outside recruitment of interests.*

Another and more deliberate example in this respect may be found in the advertisements used to recruit project managers. The advertisements usually consisted of five important elements; first the vision, then the enrolment of supporters, thirdly the enrolment of technology, then the qualifications to be held by the project manager and the duties to be performed and lastly some more practical information. Forsand Telecottage is a good example in this respect.

The advertisement was rather large for this kind of job and in the heading and the symbols the municipality expressed the vision: "Telematics and nature: Forsand Telecottage - a project for the future". This advertisement differs from the other advertisements only in one respect, and that is in its use of graphics or symbols. Several paired concepts or symmetries are introduced in the layout and the heading. In the text one finds concepts like "technology - nature" and "telecottage - future". In the layout one finds the symmetry "text - symbols". However, this last symmetry is a signal of a more fundamental relationship between culture and nature. The text expresses the culture, while the symbol refers to a specific mountain in the municipality or nature par excellence.¹⁸⁸ The layout therefore underlines important local values, interlinking culture and nature, and by introducing this kind of symmetry one also enrolls nature in support of the pilot experiment.

After introducing these symmetries the text states that this project is now established and that the ambition is to provide different information and communication services and vocational training. The co-operation of three different computer firms and FILIN is also claimed. The Telecottage will use different computer equipment, telefax, teletex and videotex and, for this,

they need a competent person with entrepreneurial abilities or, as they state, a "gründer".

The technology was of course not only "cargo", but also an important tool in the production of services. Among the three pilot experiments that "took off" one finds well-known technology like the telephone, computers, copy machines, telefax and alarm systems. In spite of rather well-known technology and a modest approach when it came to purchasing technology, several of the artifacts were never deployed in real commercial use. This was especially true of computer software.

The First Experience with Telework

"One of the most arresting images in the public imagination of our times is that of a lone figure at a computer terminal, perhaps in an isolated rural setting, linked, as it were umbilically, to employers and the rest of the world only by an electronic cable".¹⁸⁹ This image was put on trial, modified only by the multi-user setting. The first experience was rather unpromising.

Vardø had already from the very beginning some experience with telework, and they tried different alternative strategies to improve the possibilities for telework since, financially speaking, the first experience with telework had not succeeded. Finally the background of the staff members, and especially of the board, as well as the experience which was already accumulated, led gradually to the choice of quite different strategies: strategies that had telework as a more long term aim while they tried to secure the economic foundation of the firm in the short term.

In Vardø the emphasis was on the local market. They tried partly to offer new services, partly to offer a local service for those who earlier had to order services outside Vardø. Vardø is a small town with many informal networks, and the two staff members of the telecottage had an extensive network in the community due to political activity, committee work, etc. This locally-oriented strategy was stipulated by the municipal agreement under which the telecottage was established. After rather active political lobbying, the Vardø municipal government became the most important customer of the telecottage, so that during the experimental period the agreement with the municipal

administration represented 65% of income, training activities 25% and consultancy work 10%.

In Hamarøy, the nucleus of the project was Hamarøy Vaktsentral (alarm monitoring service), later named HT-Safe. This was a project that was established when the manually operated telephone exchange was closed down. The intention was to offer alarm monitoring services to a larger region, and if possible to be a part of a national network of alarm monitoring centres. This strategy failed and the centre had to concentrate its activities on the local and regional market.

Forsand Telecottage was from the very beginning a local undertaking, and since the municipality of Forsand had a high yearly income from the sale of waterfall rights (for the production of hydroelectric power), the possibilities for funding experimental activities were very good. They tried to enrol one particular market already from the very beginning. This particular market has to be understood in a Norwegian context. After Norway had to leave the union with Denmark in 1814, and during the struggle to dissolve the union with Sweden, which eventually succeeded in 1905, a major effort was put into the creation of a new written national language for Norway. The success of this was only partial, since Norway today has two fairly distinct written languages. But this in turn creates a market for translation. Since Forsand is one of the strongholds of the "traditional" language called *Ny Norsk* (New Norwegian) they also looked upon this as a potential market. However challenging this might be, the local experimental activities quickly settled on the local market in which the municipal administration was one of the most active since it was affluent. This change of orientation made telecommunications less interesting and computer applications more interesting.

The pilot experiment of Gjesdal never took off. The stated reason for this was the inability to raise money for the establishment of a privately run experiment and that, without any real experimental period, it was expected to develop into a fully fledged firm depending solely on sales for its revenue. Existing local firms did not find the idea very interesting and failed to provide the necessary capital for the establishment of the pilot experiment in Gjesdal. The outcome of the planning process, and thereby learning process, was however interesting. Ideas from the project were transferred to other projects,

and finally the mayor of Gjesdal was appointed director of a more or less competing project in one of the neighbouring municipalities.

As mentioned earlier, FILIN undertook some small pre-tests to explore technological possibilities and to let the participants acquire hand-on experience with the technology. From the report on one of these pre-test one can read that "the work to get local industry interested in communication without a clear cut profit motive was difficult".¹⁹⁰ Furthermore "we did not have the resources and budget necessary to find communication partners for those who said they were interested".

The first experience with telework was therefore unpromising, as already illustrated by the initial experiences of the four selected pilot experiments. However, this first experience was perceived as rather counterintuitive by the Regional Development Fund. Starting with new technology for communication it seemed that several of the pilot experiments primarily survived in the local market. Different interpretations were made of these first tests in the market: one important one was linked to the novelty of telework.

Instead of assuming that it was crucial to construct a viable market network and by this succeed in the market, the reinterpretation implied that the telecottages needed experience with telework to be able to improve the confidence of the market and thereby the sales of "services conducted as telework". This assumes that the absence of buyer confidence in telework was an important hindrance to the marketing of "services conducted as telework". It was therefore decided by the Regional Development Fund to develop the ideas of telework in this revised framework and they sponsored a more extensive test to try to enrol the actors in the actual marketing of services. This project started in late 1987 and was to conclude in the spring of 1989.

Shaping the Second Test Setting - Telework on Trial

In the revised framework it was important to have a better understanding of buyers' strategies. What do buyers purchase in the market? What is the buyer's rationale when it comes to the purchase of services?¹⁹¹ An important initial aim of this test was to inventory which services that best could be performed

as telework. Secondly to set up a test between interesting partners and in this process the Regional Development Fund would be a mediator between the partners. Later on new expectations were inscribed into the pilot experiments. The most important expectation in this respect was the possibility that telecottages could promote job opportunities, especially for women.

The Regional Development Fund decided that it was important to restrict the test to the existing telecottages. This decision reflected two important circumstances. First that the Regional Development Fund gave priority to telework as a market adaptation¹⁹², and secondly that they still preferred to explore organisational solutions like the telecottages as these among other things appealed to the spirit of voluntary communal co-operation often found in rural areas. *Furthermore knowledge as to how the market for services actually functioned in relation to geographical distance between producers and clients was rather meagre.*

It was therefore decided to make a small survey among medium sized and large companies in the cities of Oslo and Stavanger. The survey illustrated that the adoption of new telecommunication technology was rapid. This indicated that the technical preconditions for telework were already installed and would only increase in the future. However only 10-15% of the companies said explicitly that they were interested in the use of telework. One important question in this respect was how these firms actually bought their services prior to the survey.

We found that services such as video production, legal counselling, computer programming, vocational training, translation, graphic design and alarm monitoring were among the services most often bought in the market. Over one third of the firms indicated that they usually bought these services from external firms. For most of the firms these services were not used frequently and it would have been too expensive to organise the production of these services as a part of the companies own activities. An important characteristic of these services was that the producer had to tailor the service to the particular client. A second characteristic of the services was the fact that they required *extensive co-operation* between the clients and the providers during the process of providing the service. In other words, the services were part of the negotiation and translation process between the client and the producer.

The services that seldom were bought in the market were of two different kinds. First, services that were closely linked to the firms' own production, e.g. quality control, production control and product development. Secondly, services like sale and marketing were seldom bought in the market. Both these two group of services are directly attached to the core activity of the firm and the firm usually wants to keep them as an internal activity. The other type of services that mainly were organised internally were services in relation to the administration of the firm and its ongoing economic activities. Those were services that were important for the daily management of the firm. Perhaps the most surprising finding was that only one fourth of the firms bought computer services, which indicated that they only bought programming and training when they could not use "on-the-shelf" solutions.

Services like computer registration, accounting, document production were usually services that most often (at that time) were mentioned by the telecottages as the kind they could produce. However, according to the survey, these services were very seldom bought in the market. This indicates that the idea of telework was based on technical possibilities, not on market realities.

We found two important dimensions that determined whether the service could be routinised or not. First the task variety (to what degree do tasks emerge that are difficult to predict). Secondly, analyzability (to what degree the task can be separated into different sub-tasks, that can be solved by standard procedures and predefined techniques). A closer look at the buyers' strategies in the market enabled us to distinguish between four types of services.

1) "Routine"-services: these services are low on variety and high on analyzability. The maintenance of different data bases are an important example, and, as mentioned before, public data bases are perceived as an important example of activities that preferably should be located in the districts. For this category of services price and the ability to deliver as required were perceived as the most important decision variables by the buyers.

2) "Craft"-services: these services are low on variety and low on analyzability. Document production and technical drawing were two often mentioned examples. These services, however, are seldom bought on the market.

3) "Engineering"-services: these services are high on variety and high on analyzability. An important example was the use of vocational training courses: one can buy just the specific course one needs.

4) "Nonroutine" services: these services are high on variety and low on analyzability. Here we found services such as construction, legal counselling and graphic design. The primary service here is translation. This service has a long history as distance work. Publishing houses, etc. use outside translators on a regular basis. They seldom employ their own translators. These services are usually very important for the firm, and depending on their link to the firm's product-idea they were either conducted inside the firm or bought on the market. Quality, creativity and confidence were perceived as the most important criteria for a successful outcome in the relationship between the client and the provider, if the service was bought on the market. When a service-relationship was established it was usually a rather stable relationship that seldom was broken, and for that reason distance was of less importance. The service buyers perceived non-routine services like video-production, legal counselling, more advanced computer services and training, translation and graphic design as the most important services that could be conducted by external producers.

Later on, we compared the buyer strategies with the producer strategies of the telecottages. Eight telecottages were selected for the study and the volume of the services provided could be described as in figure 11.

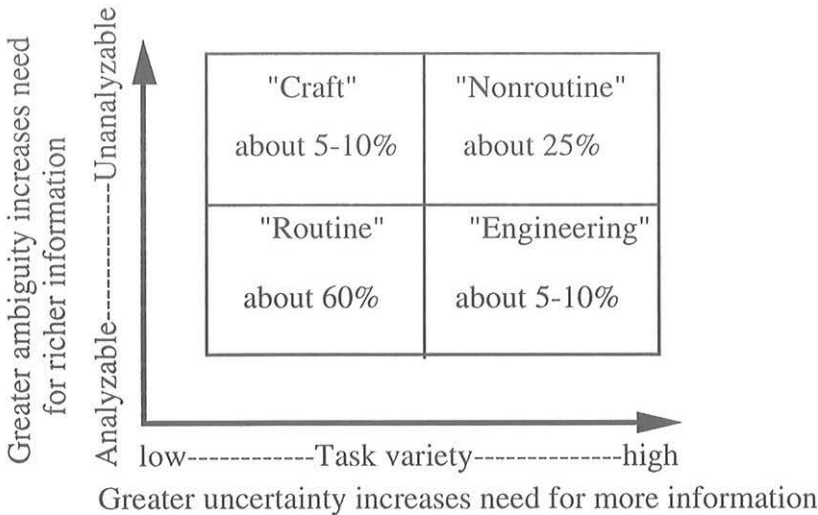


Figure 11 The variety and analyzability of services¹⁹³

Turning back to figure 7 one finds that the telecottages only took into use a small part of the inventory available and that the telecottages presented most of their "menu" as routine services. All the telecottages had routine services as their most important product: 60% of the man-hours were used on routine services. Non-routine services, mostly computer based services, accounted for 25% of man-hours. Craft-like services and engineering-like services were of only minor importance. All the telecottages produced a mix of different services, without specialising to any degree. This was also a problem when marketing the telecottage on far-away markets. Potential customer did not find this strategy convincing. *It seems therefore that the "professional conglomerate" of the telecottages, rather than specialising, caused many problems.* Vardø tried to solve this problem by refusing assignments for which they had no competence and capacity. In Hamarøy, new business units were established for the commercial ideas that were worth testing. However, none of these had more than one or at most two persons employed.

When the Regional Development Fund acquired a better understanding of the service market, the intention was to facilitate co-operation between interested companies and the telecottages. However, the survey moved the obligatory passage point from “lacking confidence in telework” to the problem of “transaction costs”.

Transaction Costs as Obligatory Passage Point

An opportunity to analyse these problems is provided by Williamson in his study of the transaction costs of market relations.¹⁹⁴ In a situation with limited resources, actors will attempt to find ways to reduce transaction costs. These may be defined as “costs necessary for operating the economic system”¹⁹⁵ or “costs necessary for operating the contractual relations”¹⁹⁶. Such expenditures consist of the costs connected with planning, negotiations, follow-up, control, and conflict-solving in transactions. The main criteria for services are therefore that:

- 1) The more standardised a service, the more important it is that the transaction costs be low. Nobody is prepared to pay a lot more for having a service rendered they might perform themselves.
- 2) The more unique the service is, the less the costs of transaction matter, due to the fact that somebody can render a service otherwise difficult to obtain.
- 3) The better the actors trust each other, the lower the transaction costs.

A key point for reducing the transaction costs between a service provider and a client, is the handling of three types of *information*: 1) The *content* of the information package itself, 2) information about performance, and 3) information about the actors. First of all, the product that the service producer can sell, is information processing. The competence to produce this *information product* becomes critical. If at the start, the competence to produce *unique* services exists, distance and the communication technology means very little. Second, the performance of the work requires *information about the performance* (we can call it work specifications). To work over great distances, thanks to communication technology, is new for most people. It is therefore important to be able to perform this work in the form of work routines and clear agreements. The easiest way to do this is by a standardised service production. This is in clear contradiction to the fact that the distance factor

means less for unique services. However, it is problematic to provide relatively standardised services if the transaction costs are high, due to geographic location.

The examples we have of telework such as text processing, may therefore only be successful to a limited degree. The pilot experiment in Vardø experienced this at an early stage and gradually had to abandon this type of telework. For a series of services which have a more unique character, as for example consultant services, the transaction costs are usually high. Therefore, distance will play a minor role. It is much easier to find examples of successful products exported as telework within the fields of consultant services, software development, etc. Finally, *information about the actors* is important in a network economy. It becomes critically important for a service producer since the distance barrier means the most for the type of service which is the least suited to be produced by telecommunications.

Interpreting transaction costs as the most important problem, the Regional Development Fund concluded that the pilot experiment with telework was difficult to implement. Other studies in Norway have, in some provocative ways, raised the question as to whether telework first of all is a luxury suited for well-educated people in metropolitan areas.¹⁹⁷ Because of the transaction cost-problem there were many indications that telework was best suited for less routinised services. Measures that can counteract this situation have yet to be tested. But one idea is joint marketing in the larger cities of services rendered by the telecottages. This was suggested as an alternative by FILIN, but never implemented.

Inscribing Technology

In the pilot experiments there were many expectations concerning different forms of electronic communication. The telecottage carried an inscription both from the Jevnaker project and from the report of the Tele Commission, that the "social invention" should enable people to work in a multi-user setting in rural areas and at the same time participate in the labour market of the larger society. This should be possible by enlarging the repertoire for communication (a problem in the hybridisation process, problem 1). The first experiences

were however rather disappointing, and the policy authorities tried to facilitate a test that gave room for the technology (a problem in the technogram, problem 2). However the small survey relocated the problem in the sociogram, and “transaction cost” for services became the reinterpreted obligatory passage point (problem 3). See figure 12.

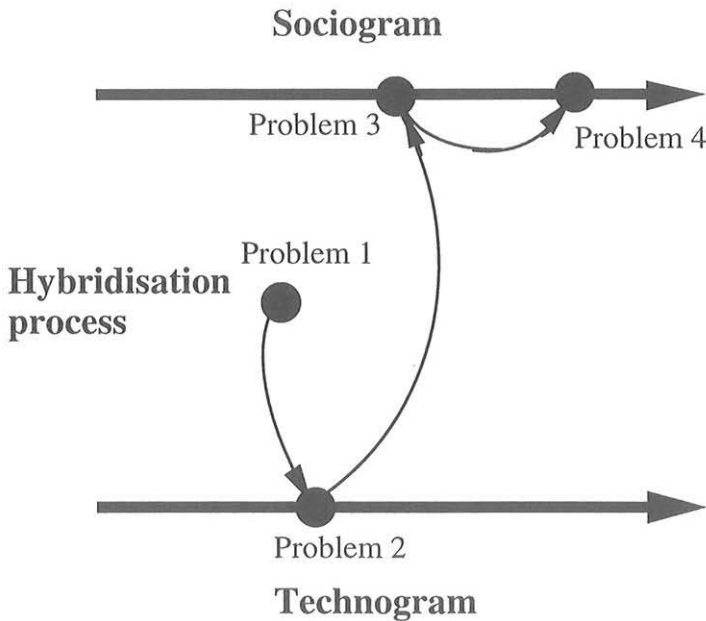


Figure 12 Successive inscriptions in the pilot experiment

No attempts were made to pass this obligatory passage point by the Regional Development Fund. Some translations were attempted by other actors, such as the possibility of joint marketing (problem 4). However, this was never tested.

The policy experiment had policy-making as its ultimate aim, and our report concluded by stating that principally we saw two possible different measures:

- Try to decrease the transaction costs by;
 - 1) either infrastructural measures such as decreasing the cost of telecommunications and the establishment of a more flexible electronic market (and thereby decrease the entrance cost in the market), or
 - 2) to facilitate the establishment of strategic networks in the market, by giving "network" grants, etc.
- Enhance the level of competence of potential entrepreneurs by:
 - 1) enlarging the use of marketing support and
 - 2) facilitating the use of regional centres of excellence.

In our conclusion we perceived the "telecottage" as a valuable "think-tank", but not as a lasting phenomenon in the market. It was therefore time to rewrite the script made by the Tele Commission. How do policy experiments like this influence policy-making and the policy-makers perception of technology?

Before I try to answer this question, one word of caution. It will always be very difficult to trace whether a specific experiment really influences policy-making, one may always claim that the influence came from somewhere else. To restrict this possibility I have only included policy documents in which one finds direct personal links between the persons writing or executing policy decisions and the persons who participated in the policy experiment as representatives on the steering committees.

Parallel to the pilot experiment the Ministry of Local Government funded a program called "Private services in the districts"¹⁹⁸. This program, which lasted from 1987 until 1991, took place alongside the policy experiment and had, among many other activities, telematics and telecottages on its agenda. During the program more importance was given to competence as part of the strategy for rural development with telematics.

A degree of influence may be found in the White Paper called "Policy for regional development" of 1988/89¹⁹⁹. In this White Paper the Norwegian Government stressed as especially important many tasks and, among them one finds:

- The Government should contribute to promote geographically dispersed small businesses and enable them to provide more diverse employment opportunities and a more balanced economic activity in rural areas; by contributing to the creation of business activities in the field of private services giving priority to information technology and new services (especially Value-Added Services) and knowledge-based services (especially R&D and different kinds of consultancy firms)
- The Government should contribute to raise the level of awareness of the potential of information and communication technologies and contribute to raising the level of information and communications technology skills in rural areas.

Norway has long traditions for the decentralisation of public activities. Since it has been difficult so far to decentralise already existing institutions, policy makers have concentrated their efforts on the localisation of new public institutions. The establishment of different kinds of public databases has therefore been considered in the perspective of decentralisation. Several public databases are already located in the regions and a Commission established by the Ministry of Industry and the Ministry of Local Government concluded that the location of public databases may be regarded as important instruments in regional policy.²⁰⁰ The Commission emphasizes that it is crucial to take into account the importance of location, the competence required for the different jobs and of course how to get the best effects out of such a decentralisation. The document is very careful not to promote public authorities as a "lead user" of telework.

A closer look at the outcome of the actual pilot experiments gives rise to one common conclusion. In all the four communities, some participants learned how to conduct projects or experimental activities. This competence was later translated into new projects, most of them with new technology. Examples are 1) Telework for disabled persons, 2) Telework for schools, making educational programs, 3) A centre for small and medium sized firms, with the aim of facilitating innovation of new technology, 4) Distance education. All are more specialised activities, based on competence acquired in the pilot experiments. None of the pilot experiments continued according to the original program for action.

Finally, the Regional Development Fund implemented a policy that gave greater importance to the economic viability of new business ideas. The experimental period was therefore more or less over; independently of the experiences with telecottages. However, several later projects were turned down

or asked to make a better evaluation of the potential markets for their business idea, before re-submitting the application.

Inscribing the Test

Jevnaker served as a frame of reference for the pilot experiments, and the ways of interpreting the successes and failures of Jevnaker strongly influenced how the problems in the pilot experiments were perceived. Distance was perceived as a critical problem and both the Ministry for Local Government and the local actors shared this view. The relationship between problems and solutions was framed symmetrically, as in the centre-periphery relation, and geographical distance was perceived as the problematic part of the relation. The technological solution to long-distance communication was telecommunications and, if the variety of technological solutions or the technological repertoire could be extended, the different actors anticipated an easier solution to the problem of geographical distance.

The testing situation was therefore constructed with distance as one of the main variables - the designers of the settings inscribed in the testing situation a program of action that implied a desire to be "present" when being absent. This assumption is founded on the idea that "peripheral" people would prefer the best of both worlds: from the centre and from the periphery. The best in the centre being the job-market, the best in the periphery being nature and multiple social relations in the local community. A new type of actor was therefore invented.

Furthermore, the actors asking for the test wanted to test a specific organisational setting. However, a negative outcome of the test was as interesting as a positive outcome. Even if this to a certain degree also had been the situation in the Jevnaker project, the expectations in the pilot experiments are usually higher about a positive outcome than in more explorative experiments. As social scientists we were therefore caught in the middle between the authorities expecting a more general outcome and the local participants expecting a local success.

In the pilot experiments, too, it was important to enrol modern communication technology. However, at this stage in the testing the technology

was to be enrolled in a framework of market demand. The focus on the market was perhaps the most important difference between the Jevnaker project and the pilot experiments. The test setting was extended from the more controlled social "laboratory" to also involve the market. How do different new services, produced with the use of modern communication technology, compete on the market?

In the context of frame analysis Goffman suggest an analytical concept he prefers to call the "key". He hereby refers to the set of conventions by which a given activity, one already meaningful in terms of some primary framework, is transformed into something patterned on this activity but seen by the participants to be something quite different. This process of transcription he calls *keying*.²⁰¹ Several types of keying are suggested for technical redoinings, i.e. small part of what could have been ordinary activity can be performed, out of their usual context, for utilitarian purposes quite different from those of the original performance. This assumes that the original outcome of the activity will not occur. To mention three relevant examples (according to Goffman):

1. Practising implies activities that are close to the real thing, without being the real thing. Rehearsals are one common example.
2. Demonstrations which are performances of a task-like activity out of its usual context in order to allow someone who is not the performer to obtain a closer picture of the activity.
3. Experiments in which "natural" conditions may be maintained as much as possible, except that natural reasons do not exist for the performance. If the term "key" can unreservedly be applied to experiments it must be assumed that the participants in the activity all share the same assessment of what is happening while it is happening; namely an experiment of a particular kind.

Testing situations entails rehearsals, demonstrations and experiments. However, Goffman claims that the analytical concepts are only usable if the participants share the same assessment of what is happening while it is happening. In this respect, I will claim, the semiotic vocabulary makes it possible to analyse the experiment even if the different participants compete in their definition of the situation. This competition was explicit in the pilot

experiments, and may be explained by a competition between different frames of reference. While the Jevnaker project was double framed by the strategy of coalition and negotiations, this was not the situation in the pilot experiments. In these experiments the test setting involves the market and by this circumscription the production and sale of services was given priority. However, the competing frame of reference was between the national authorities inscribing in their strong program the need for policy input, while the strong program, seen from the viewpoint of local participants, was the creation of local jobs and the acquirement of new skills. The social scientists were enrolled in the local participants' frame of reference to ensure the success of the projects. In this way the researchers were ascribed the role of mediators between different technological solutions and the perceived market demand and, finally, the national authorities. In the final report we summarised the results of this process as a one starting with many possibilities, but resulting in a rather restricted use of new communication technology - or a process of trivialisation.

The effort to enrol new communication technology revealed several important characteristics of this technology. First of all the technology that had proven to be useful was already on the market, while the technology that created the excitement and futuristic visions was not yet ready for the market. However, this was not the most important characteristic. Even more important was the fact that it was difficult to identify the market for these more visionary technologies.

Some of the projects tried out two-way video transmission for distance education. As researchers we had to warn the projects' participants not to enrol this technology in the activities that should be paid for by the market, but to organise them as separate projects with public financing. Later on this technology was not taken on in the more market-driven core of activities, simply because it was impossible to enrol it in the market. However, concentrating on "shelf"-technology, the production of several new services was tested.

Several problems confronted the test. First of all, as Goffman pointed out, these new services were often produced as "demonstrations" and, since nobody will pay full price for a haircut by a trainee, neither would anyone pay the "full" price for a new service in the making. A new service in the making lacks the necessary confidence of the market. So even when the market was enrolled,

it was difficult to make this the market of the "real world". Secondly when the supporters in the public sector realised that this was not a quick way to success, they started to withdraw. Thirdly in the recruitment of personnel strong emphasis was put on competence. However, the acquiring of new skills and also the transfer of tacit skill to new employees was more expensive than was foreseen. Lastly, distance was in fact important; simple services could not pay for marketing and transaction cost on far off markets.

These factors turned the technological image in a more banal direction; the result being either a stronger focus on the local market for different kinds of service activities or on more trivial telephone services like telemarketing or more "pink" services.

I would argue that the most important reason for "failure" was not the different circumstances leading to trivialisation and later to the closure of several of the projects, but the way different actors framed the important problem to be tested and how they decided to judge the results of the test. Even a pilot experiment cannot fully be judged by the market, since the market will never treat this kind of project as "real" firms. The main problem was therefore the national authority's strategy for diffusion of innovations. If one chooses a strategy that has the characteristics of technology-push one cannot treat the project as if it was market driven. *The shifting out of a frame of technology-push and into a frame of demand-pull without taking this shift into consideration was the main factor that made the projects an impossible enterprise.*

I will therefore claim that the very active diffusion of innovations strategies, the dissemination of knowledge and images about telematics in the 1980s had as a consequence a repetitive reproduction of similar perceived problems and solutions, very often resulting in so-called incremental innovations.

The first result of the test with telework was therefore perceived as a problem, since the Regional Development Fund had hoped that it should be the most routinised services that most easily could be provided by the telecottages, not the least routinised services. Less routinised services implied also that the general competence level of the rural communities did not fit very well with this type of service provision. Furthermore it was already known that several enterprises providing similar services preferred a central location in an information milieu in order to reduce the cost of obtaining information.²⁰² However, the more systematic understanding of transaction

cost that was gained during the test, involved also a reinterpretation of the research problem.

Originally the research problem was perceived as that of the hybridisation process (the telecottages and the participants need experience with telework to be able to improve the confidence of the market). Our finding was, nevertheless, that the transaction cost for service provision was the most decisive variable (a problem in the sociogram). It was therefore difficult to set up a real test situation between the telecottages and a group of service clients. We researchers finally suggested that we could use the Regional Development Fund itself as an important service client. Not very surprisingly, they declined to participate in such an experiment since they already had organised their service provision to their own satisfaction.

Finally, we agreed to write a "manual" about the use of telematics in rural and regional development. It was important that this manual gave a "realistic" picture of the opportunities and not the least the problems, since the Regional Development Fund wanted to restrain local enthusiasts from applying for more money to invest in new telecottages.²⁰³ However, the sceptics had already arrived on the scene and this was also one of the reasons why the Regional Development Fund wanted to conduct this test. In a critical account in *Computer World*, the headline and the text concentrated on the symbolic function of technology.²⁰⁴

By the magic word of "Sesame sesame telematic" they introduced the article by stating that the concept "telematic" was the new trendy concept in rural development. With this magic formula it was possible to get money from the Regional Development Fund. The statement was illustrated by a satiric drawing of a rustic telecottage with a postbox in the front. On the post box in the drawing is written "Regional Development Fund money here". The article contains critical comments from local project managers claiming that the only actor earning money on the activity was Telenor. In spite of this, the Regional Development Fund claimed that they knew nothing about the profitability of telework, which later sparked off the test I just have described.

Inscribed in this test setting was the image of the telecottage. This image was translated by different users into a possibility for rural development exploiting the best of two worlds. However, the reinterpretation by both the local project managers and the Regional Development Fund was that this

was not possible. Therefore with no lasting relationship to any remote market, the surviving telecottages clung to the local market. Eventually it became clear that advanced telecommunication technology was not necessary to survive on the local market.

However, the article in *Computer World* introduced a new promising project, the FUNN-project, and the last word in the article is given by a local project manager stating that: "If we had got the offer to participate in the FUNN-project we would have accepted. They do not have to be afraid to take a stake in us. We are to be sure situated in the middle of mountains, but also here you find sensible people, that do other things than hunt reindeer!" With this statement I will draw the attention to the next chapter. What happens when one replace the focus of a strictly "social invention" with an unequal combination of social and technical inventions?

7. The Demonstration Experiment

Defining the Role of the Hybrid Community

Hybrid communities have been used as demonstration experiments and thereby important tools in the dissemination and diffusion of information and communication technologies. They have been used to imbue strategic actors or entrepreneurs with the ability to promote specific solutions among pre-selected target groups to enhance overall knowledge and acceptance, and thereby speed up the diffusion process. However we know that the reason why a solution or invention fails in the market is not necessarily caused by technical shortcomings or the lack of sophisticated solutions, since technical solutions may succeed even if their competitors seem to be better.²⁰⁵

In the inscription-translation-reinterpretation process a technical solution may change radically and the final solution may be an answer to quite a different problem than intended. Taking this into account, it is important to get a better understanding of the rationale in the inscription-translation-reinterpretation process resulting in either "failures" or "successes". In the study of critical problems in this process, one has the image of "rational actors". However, sometimes R&D-actors are portrayed more like tourists than inhabitants of reality. This is certainly the picture given in critical journal articles with headlines such as "Computer-billions in the blue - taxpayer's money straight into the sky"²⁰⁶. One of the projects described was the FUNN program. According to the journal mentioned more than 205 million NOK were "burnt from the time the idea was born in 1987 until 1991 when the project was cancelled".²⁰⁷

This chapter discusses what happens when the test setting is well defined, and the inscription and translation is perceived to take place with the help of rather predefined solutions and technologies. The enrolment of solutions, technology and users was, however, problematic. The case study focuses on "interpretative flexibility" and the "technical content" of artifacts seen through the eyes of different relevant social groups. However, not only is the "relevant social group" of special interest, but also how relevant social groups "negotiate"

about the establishment of a specific frame of reference or “relevant frame of reference”.

The case study is the AURORA project that was part of the FUNN program. In the bright optimistic phase of the project the actor-network named their system for travel and tourist information “AURORA” after *aurora borealis* or the northern lights. As many of its predecessors, AURORA later failed to meet its objectives and the large scale system for travel and tourist information was never implemented. However, it is not possible to understand the AURORA project without understanding the logic of programs like FUNN. The FUNN program was the initiative of Rolf Skår, at that time director of Norsk Data A/S. Norsk Data A/S has, since its inception, been the prince in an industrial fairy tale. A small country managed to build an important national computer producing company, perceived by both industry and the political authorities as an industrial dynamo. Norsk Data A/S still exists in a much reduced state, but is not longer an important computer producing company.

Shaping the Test Setting

Early in the spring of 1987 the director of Norsk Data, Rolf Skår, wrote to the Ministry of Industry suggesting a project for regional development involving the establishment of 13-18 larger FUNN centres for research and development in rural Norway.²⁰⁸ The centres would install computers produced by Norsk Data. Furthermore, they should be linked together in a network, preferably in co-operation with Telenor. Only three weeks later, the director of the Norwegian Council for Scientific and Industrial Research wrote to the Ministry of Industry and declared their interest in the proposal, offering help to plan and implement the project. A working project group was rapidly established with participants from the Ministry of Industry, the Ministry of Local Government, the Regional Development Fund, Telenor, the Norwegian Council for Scientific and Industrial Research and Norsk Data.

The project group was headed by the political adviser of the Ministry of Industry, Kari Blegen. In civilian life she was director of Eastern Norway Research Institute²⁰⁹ and had a PhD in civil engineering. All in all a background

that, in the estimation of supporting actors, linked many of the ideas that the FUNN program was founded on. That Norsk Data also had other ideas, like “buying” their own machines by using an internal fund set aside by tax incentives, was never perceived as a real hindrance to the project.²¹⁰ However, the tax issue was a legal problem that later on had to be solved in a cabinet meeting, since some of the FUNN Centres were not in the regions reserved for this kind of investments.

After an open tender in May 1987, 51 “actor-network groups” announced their interest in hosting a FUNN Centre. In August 1987, the Government agreed that Norsk Data could use 135 million NOK for this purpose. In September, a steering committee with Blegen as chairman was appointed and in December the same year the Blegen-committee suggested that 13 powerful mini-computers should be distributed among the 15 designated locations. The geographical locations suggested encompassed 13 places stipulated by the Regional Investment Act, and 2 places not stipulated by the act.

In May 1988, the Government decided that 14 powerful mini-computers should be distributed. The centres should be linked to a national network to be operated from the centre in Mo in the municipality of Rana.²¹¹ In the following, I will first briefly describe the history of the project:

- 1988-1989. The inauguration period of the FUNN centres. The program director regards FUNN as successful if 60% of the FUNN centres succeed both in economic and scientific performance. No time limit or quality level is mentioned.²¹²
- July 1989. Initial evaluation report by Norwegian Council for Scientific and Industrial Research
- Fall 1989. Change of strategy. Negotiations with new partners such as NIT.²¹³ Negotiations with Norsk Data to reduce the running costs.
- January 1990. NIT takes over as operator of the network.
- January 1991. New agreement between NIT and Norsk Data results in a transfer of operator responsibility, from NIT to Norsk Data
- January 1991. Public authorities terminate general appropriations for the FUNN centres and try to support only those projects that might survive without generous support.
- March 1991. Norsk Data offer the FUNN centres a *free* choice of technology and services, among these Norsk Data supply.

- Spring 1991. The FUNN-network is closed down as a separate network and integrated into UNINETT.
- August 1991. Most of the equipment is handed back to Norsk Data, and replaced by other equipment (if the FUNN centre is still running).

Computers as Obligatory Passage Point

The definition of the obligatory passage point was defined by the initiators as the strong mini-computers of Norsk Data. In their PR-brochure signed by the cabinet ministers of Industry and Local Government, by the chairman of the National Committee for Information Technology, by the director of Norsk Data and finally by the director of the Norwegian Council for Scientific and Industrial Research they state that:

“The computers supplied by Norsk Data are located in highly qualified regional centres of expertise which have the potential to carry out forward-looking projects for the benefit of their own regions. The FUNN programme will reenforce the links which exist between the authorities and the Norwegian computer industry. It will also raise the standard of the technical equipment available at the regional centres of expertise, and demonstrate that decentralized research and development can be performed when a first-class computer network with sufficient computing resources is made available to users.”

With this strong emphasis on the technical equipment, it is interesting to note that the technical aspects of the computers are described in a chapter consisting of half a page in the Blegen Report, while the network is discussed on the next 20 pages. One important reason for this may be found in the use of equipment from only one supplier. Critical commentators stressed this point and some few potential host institutions refused to be designated as a FUNN centre for exactly this reason. The Møre Research Institute was among these, claiming that competence was more important than equipment.

However, if we return to the PR-brochure produced by the initiating group, we find no alternative obligatory passage point presented. The machines are regarded as prerequisites for the centres and will enable the centres to provide local expertise which can be used by industry, the public sector, research,

schools or individuals. The centres would enable users to utilise expertise without expensive investment in their own equipment and even more important: "When the FUNN centres were being established, the authorities earmarked funds for FUNN projects. If you have a good project idea, you can co-operate with your local FUNN centre in applying to have it partially financed via a grant from these project funds". However, as early as January 1991, the funds earmarked were removed; two years after the first centres were established (and only half-way through the four year experimental period).

Choosing the machines as an obligatory passage point created several problems summarised by Ola M. Johnsen (the FUNN co-ordinator at the research council since August 1989)²¹⁴:

"Equipment not adapted to the requirements (Wrong equipment at the wrong point of time). This was a fundamental problem from the very beginning. The FUNN centres were paying for maintenance of equipment that was not in use. Almost all of the centres had problems finding tasks for the Sintran-machines.²¹⁵ The process of replacing the Sintran-machines with the UNIX-machines was delayed for too long."

As already mentioned this stumbling block was confirmed by the change of strategy in January 1991. During the fall of 1991 three of the centres closed, and the rest had either replaced the original equipment by more feasible equipment from Norsk Data or (most of them) acquired equipment from other companies. The obligatory passage point was by this change in strategy transformed from "Norsk Data Machines" to the "Market".

Many of the centres never regarded the Norsk Data machines as the best solution. When the project was promoted in the municipality of Gjøvik, many of the local actors commented on this. One important comment made by several participants was that Norsk Data machines were certainly not the only possible choice of technology to perform interesting research and development activities in the regions. However, the impression that most of the possible local actors were left with was that the acceptance and enrolment of machines from Norsk Data was a prerequisite for receiving any money at all from the funds earmarked.

The prevailing view was that the FUNN-network would, for many years to come, constitute the group of actors in the regions that would harvest most of the available public money for regional IT-research and development.

This was perceived both as a possibility and as a threat by possible local actors, a perception that later was confirmed by the fact that the Regional Development Fund in 1988 used 96% of their “open” program money for applied information technology on the FUNN program; and in 1989 92% of the money was used for the FUNN program. Originally only 75% was reserved for the FUNN program in 1989. The reason they gave in their annual report for using 92% was that there were very few good projects from other applicants.

Locking Allies into Place - Enrolling AURORA

The FUNN program did signal a strong emphasis on the importance of both technical and social networks. Furthermore in the Blegen-report the different possible centre hosts are evaluated according to their potential as strong actor-network groups. However, later on the founding actors of FUNN created five more loosely organised R&D-networks with the 14 FUNN centres as the “main” actors, to “guide” the development of networks. Each R&D-network should work in a pre-defined field of activity. The fields were selected on quite different criteria; some because of the perceived need, some because of the perceived potentials. In this chapter I will restrict myself to the R&D-network responsible for the “Tourist-sector” also called Travel-FUNN. The organisation of Travel-FUNN is illustrated in figure 13.

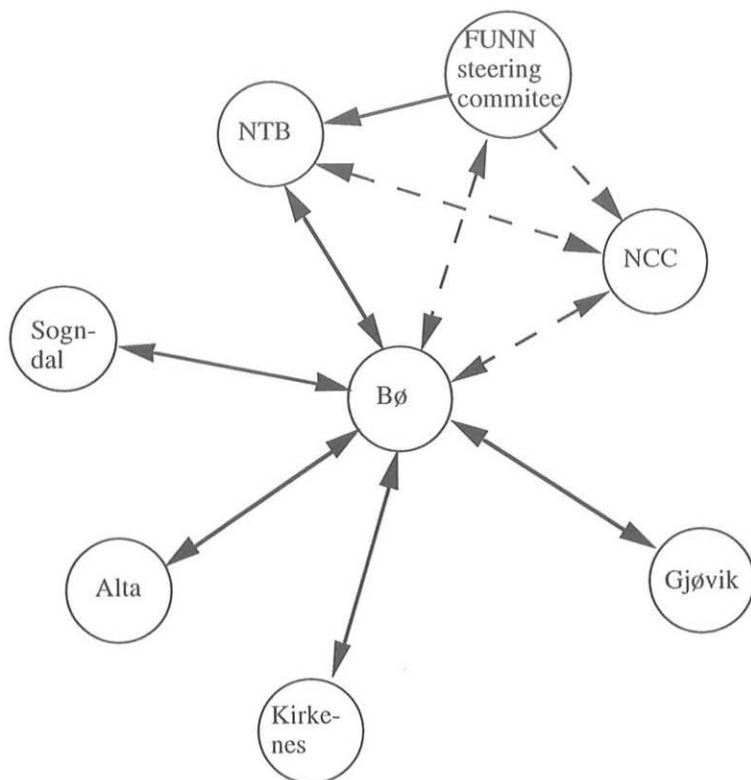


Figure 13 Travel-FUNN actor-network core

The centre in Bø functioned as co-ordinator, while the centres in Sogndal, Alta, Kirkenes and Gjøvik joined as equal members of Travel-FUNN. In the FUNN program, the Norwegian Tourist Board (NTB) was the first and the most important customer. However, as a customer, NTB was mainly financed by funds earmarked for the FUNN program. In the initial period, the task of the Norwegian Computing Centre (NCC) was to write a research proposal for Travel-FUNN. Later on, NCC would be an experienced guide or senior

partner of Travel-FUNN. This artificial network was created by the FUNN program and the leading role as co-ordinator was a delegated function, not a function arising from competence or strength.

As already mentioned, the R&D process in communication technology is often characterised as a search for "problems" to predetermined "answers". This statement reflects the fact that the interaction between research and industry is in transition - from the stability and order of the industrial era to the flexibility and uncertainty of a "post-industrial" future. Recent economic and technological development has underlined the importance of new forms of division of labour between firms and institutions. *Networks* seem to be the guiding concept and the prime mover in the diffusion of innovation approach.²¹⁶ However, as useful mechanisms for policy development aimed at supporting the inscription-translation-reinterpretation process of technology, networks seem to be poorly understood.

A number of evaluations have shown that diffusion of innovation programs are based on conceptions of networks that are not necessarily related to the actual behaviour of people and firms. One often finds that firms or actors are "lumped" together in spontaneous project groups in order to qualify for funding through an existing R&D-program. Networks are then seen as structures that are *transient* and established for the program as such. The network relations that actors already have with other actors are rarely taken into account. Nor are networks perceived as lasting relations between firms and R&D-organisations. Sometimes, such official networks are dysfunctional to the network structures already in place. Projects designed to build networks, lasting and personal relations between people in different organisations have been seen to develop as substitutes for managerial loneliness without having any effect on the innovative behaviour of the firms involved.

Although the history of networks in innovation policies is far more complex than the AURORA example suggest, I will argue that networks materialise in two rather different policy-related conceptions:

- 1) Networks should be used as transient structures in technology transfer or renewal. As transient structures they constitute mechanisms for distributive welfare policies in the sense that public funds are to be distributed "democratically" among firms or organisations. Furthermore, networks are

both imperfect markets and imperfect organisations, and are therefore not reliable as lasting and effective tools in innovation policy.

2) Networks, as they appear in “reality”, are too effective as mechanisms for technology transfer and renewal. Using networks as a basic tool, means that firms will generate profits from the policies, they will tend to restructure and engage in relations that resemble monopolistic or oligopolistic structures. Networks are structures that are to be avoided in their “natural” form in technology policy.

In this sense, the idea of networks is double edged: something on which to build policies as well as something to be avoided. While the FUNN program hoped that Travel-FUNN would develop into a strong R&D-network, the result was a transient network that dissolved only a couple of years later. I will elaborate on this fact both in terms of frames of reference and the interpretative flexibility of networks for communication.

Allies on the Move

In the first evaluation of possible hosts for FUNN centres, 19 of the 51 applicants were selected for further evaluation. The description of these 19 applicants included a short presentation of the municipality, local activities and ideas for new activities, and finally the possibility for specialising in “3-5 spheres of activities”. One important criterion was their capacity to activate local networks contacts in higher education, research and development, local industry and local public authorities. The selection of “spheres of activity” partly reflected local competence, expressed need and a perception of a “natural” division of work among the possible hosts - “the planned profile should as a starting point reflect the profile of the regional industry that the region has or plans to have” (emphasized in the Blegen report, p. 31). The important frame of reference is the regional context, the national context represents the sum of the regional variation that enables the “total network to perform a diversity of services”.

Among the centres that by geographical location were defined as relevant for R&D on tourism, the FUNN program selected five to participate in Travel-FUNN. The FUNN-initiator group indicated that they would use several

million dollars to improve communications in the complex network of actors in the tourist sector and the AURORA-project started with this in 1988 as the founding activity of Travel-FUNN. Later on, R&D-activity should result in a snowball-effect, accumulating competence and research projects in Travel-FUNN.

To spark off creativity and interchange of information between actors in a network the following three factors are of special importance: a) job mobility b) competition and c) co-operation. AURORA was a common task for Travel-FUNN, and as such was a task that gave room for both competition and co-operation. First of all, this version of co-operation was introduced by the founding group of initiators, and the five participating R&D-members interpreted the co-operation as how to divide the different tasks among the members. Travel-FUNN never managed to enrol the Norwegian Computing Centre in the actor-network; perhaps because they were competitors in the same R&D-market. Each task was accompanied with a certain amount of funding and the different tasks varied in their prospects for well paid and interesting tasks in the future. The framework for co-operation was therefore also a framework for competition and the actors in the network were often competitors in the same market for institutional fund-raising.

Paradoxically, the actors in the inner core of the Travel-FUNN actor-network were linked together by weak ties, while each actor in the actor-network had their own original networks distinguished by both strong and weak ties. So instead of a strong inner core with many both strong and weak ties to more peripheral actors, the actor-network had a weak inner core with many both strong and weak ties to actors in their own local setting.

To select the really innovative problems, national expertise was called on, and the Norwegian Computing Centre made a summary of the possible problems, solutions and actors. Later on this summary was the basis for further development. On the first page of this summary we find the five main elements in the story. In the first element the scientists underline that in the 1980s there had been several initiatives to develop computer based information systems for the tourist sector. However *most of the initiatives failed* and in 1988 there was only some booking systems among the largest hotels and transport companies, including the travel agencies. The second element is an elaboration of the main problem that tourists have to use a large set of

communication channels to sort out the necessary information for their travel plans. See figure 14.

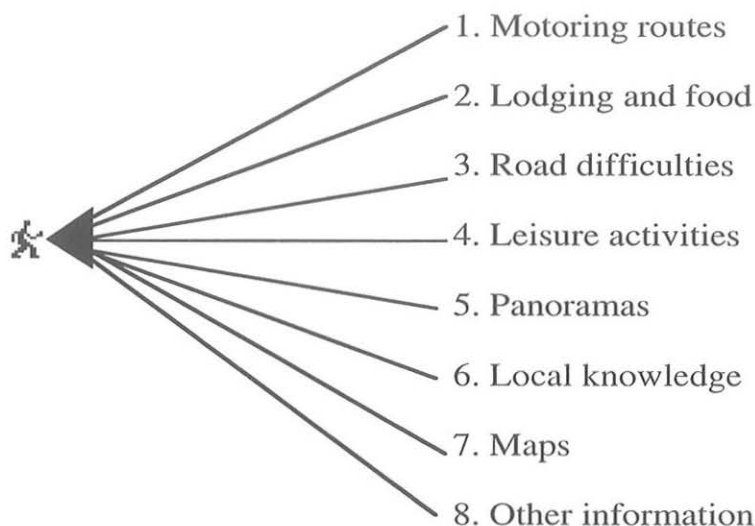


Figure 14 Communication channels

In *reality*, the scientist tell us, the tourists are looking for a joint information look-out where they can find all the necessary information about the place they want to visit; since they are tourists in a locality and not just customers of a single hotel, restaurant, ski-lift, etc. This system has therefore to be flexible and available at many places and at any time. The third element they underline is the competence of the actor-network in preparation and as the forth element they propose how to build up the necessary actor-network. Finally, they focus on the ordinary traveller as the main target group, but will of course also take care of the interests of the brokers.

Their world view is depicted in a journey made by two couples, at least one of these travellers being a scientist. These model tourists illustrate the problem of information. How to get the necessary information about all the

different activities, problems, solutions at any time and any place? Since this was a rather long journey, covering perhaps 4000 km., they had many opportunities to look into the problem of information. Nowhere in the paper however do they mention that it is a burden to collect the necessary information on the spot, the active collection of information gave, on the contrary, room for spontaneity and surprises.

The concluding remarks emphasize that the information has to be presented in an attractive way, that such a system is difficult to make, that there are several failures in the field already which have been too expensive to maintain and update and with a difficult user-interface. The buyer of the system has, therefore, to decide how and why - is it for higher income, more tourists, better tourists, tourists that spend more money, satisfied tourists or what? After stressing all these problems the scientist explores the different technological possibilities in his small pre-test. On this background Travel-FUNN started to work, winding their way through a rather slippery terrain.

A pivotal question is to what degree the ordinary tourist wants to be informed before the experience or to what degree the collection of information is part of the experience? How do different user groups define information as a problem? How does the producer enrol users in the definition of the problem? Or, as Maxine Feifer asks,...why, in the McLuhanesque technological "global village" that the world had become, would anybody need to travel at all? You could stay home, read and watch TV; save money and avoid crowds.²¹⁷

The recruitment of participators in the tests of specific technological solutions is much more goal oriented and the actors are often selected for the promotion of a specific result. When Minitel terminals were tested in two smaller towns in Norway, efforts were made to select producers and users of information that the project makers imagined were the most likely users of the system. A similar situation occurred for the tourist and traveller information system. The intention was to enrol the most likely users of the system. However, several of the key user groups were not ready to accept the core idea of the project and refused enrolment. Without the "lead users" it was difficult to construct a convincing project and the actor-network of AURORA started to dissolve.

As discussed earlier, the technological solution sought, such as the information system described, was framed so that the prescribed users were

envisaged as tourist and travellers with a great need for information. The R&D-team therefore had a perception of the potential user that was shaped by the prescribed user. A prescribed user being a person that prefers to communicate with technology instead of persons acquainted with the locality. The technical solutions are first and foremost compared with other technical solutions and not with traditional forms of communication.

Since the commercial actors had little interest in the project, they preferred that the information system be paid for with public money. When the framing of problems and solutions develops quite differently, the framing is not only a reflection of different access to important resources, but also an important indicator of a different degree of involvement. The hybridisation process is therefore both influenced by the development of technology, and by an active involvement in the life of society. In this respect the planned information system undermined the more "irrational" benefits of travelling.

Inscribing Technology

The scientists negotiated with expected users about a complete "Information- and booking system", even if this was not explicitly in the terms of reference of the Norwegian Tourist Board. The reason may be that this was technically more challenging and the potential profit greater. One even more interesting explanation is, however, that the booking system was the only part of this information system that was directly linked to the service-core.

In any commercial information system there has to be a core service which the users, often reluctantly, accept having to pay for. Sometimes this service is charged at a critical point in the information system - as in the Norwegian slalom pist. While it is the slalom pist that attracts the users, they are charged for the ski-lift. Since information very often is perceived as a resource free of charge, the scientists preferred to charge for the information indirectly. This indirect payment could be organised through the booking system, since customers usually accept paying for transaction costs. As illustrated in figure 15 a booking system may enrol users such as hotels and restaurants, travel agencies and travel operators and transport companies. The R&D-team negotiated with different possible user groups. But with no great success.

During the negotiation process, they had described the system and its potentials in a brochure used to enrol new strategic actors. In the drawings one finds information terminals both at quay side, in the forests, at hotel receptions and at large exhibitions. The drawings are supplemented by a text telling potential strategic actors that "Visitors have a incredibly large need for information. The need grows when the visitors feel that they have to wait for the ferry, food, bus, etc."

When the brokers in the travel and tourist sector (e.g. travel agencies) withdrew from AURORA, the R&D-team felt forced to select individual users as the main target group. As illustrated in figure 15 the possible user-alliances grew smaller and less powerful. This shift in the mental mapping of the problem had consequences for the loyalty of the actor-network. As one of the researchers said: "When we saw that the project would be a failure we started to withdraw. We did not want to be associated with the failure of a big project in which we had only been a sub-contractor".

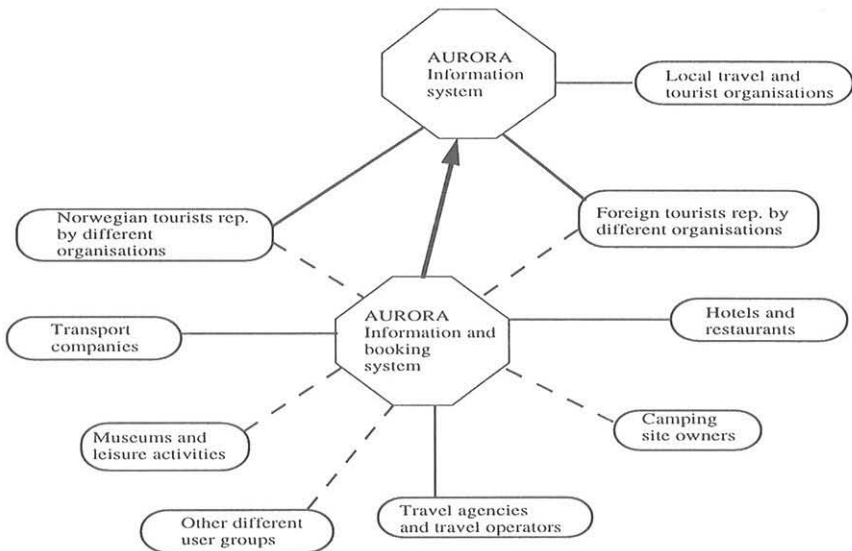


Figure 15 Adapting solutions to users

Inscribing the Test

One of the main actors in the AURORA-project summarised his experience with AURORA:

"The experience with AURORA in the FUNN program give us a feeling that many researchers are looking for a problem instead of finding a solution for the tourism sector in Norway. From the start more actors from the tourism sector should have been included to guide the project in a better direction. Next time one wishes to implement a similar project one should first of all find a part of the sector which has problems that need solving, thereafter develop a concrete product which has customers and further possibilities - not the other way round"²¹⁸

The testing of solutions relates to the problems in a somewhat different way than the testing of possibilities. The choice of a specific solution puts stronger emphasis on the technology and the process of shaping this technology. The solution may be well known, but the relationship between a particular solution and a particular user group unknown. Unknown are also the specific user interface that is needed; how the technology really adapts to user problems, and last but not least, how the solution really helps the users in solving their problems.

The AURORA-project started out with a definition of needs by the policy authorities. How this definition was established is unclear. At least two quite different inscription of needs may evolve in the description process. First, the fact that the tourist & travel-sector really needed a better information system. The second possibility being the fact that the policy authorities needed a tool to promote a better integration of the sector.

The R&D partners had an even more demanding script. In a short time period they had to establish a market relationship that made them relatively independent of public money. A big "hit" in the R&D-market was therefore seen as very important. It was therefore not enough to fulfil their obligations to the policy authorities, if the end product was not perceived as saleable on the market thereby generating further sales among potential customers. The R&D partners therefore interpreted the script and prescribed a wider range of qualities than originally intended. In their frame of reference, a successful system was a system that the market would buy, while the policy authorities

thought that an advanced technically system could be more or less imposed on the different actors by its own momentum.

The circumscription of the setting was therefore quite different, and the strategy of the R&D partners was to enrol the different important actors into their frame of reference. This was done by an attempt to prescribe more commercial activities in their task or script. However, this failed for two reasons. First of all because the official buyer of the R&D-solution did not permit it. But also because the R&D partners did not manage to enrol the actors in the market into their framework and thereby enlarge the setting. If this last activities had not failed it is possible that the original buyer of the R&D-solution could have been convinced to enlarge the setting.

The content of the R&D-process is a little ambiguous since the R&D partners already during the start-phase demonstrated that it was not necessary to create a new information system; well functioning systems were already on the market! One important reason for this paradox, I would suggest, is the fact that the R&D-process was perceived as an important strategy to enrol actors in support of a new system. *While the policy-authorities framed the problems inside the sociogram, the R&D-actors were obliged to work on a level that gave priority to 'allies' in the technogram.*

8. The Replication Experiment

Defining the Role of the Hybrid Community

When the technology is well known to both policy-makers and many of the relevant social groups, the typical replication or dissemination experiments can be used to disseminate tested methods, techniques or models and thereby provide social and technological innovators with a test-bed for thought before full-scale implementation. This may be important when the technology is perceived as obvious and taken so much for granted that, in countries like Norway which is sparsely populated with vast areas of forests and mountains, we would have a hard time to find any place at all that is more than 10 kilometres from a stationary or cellular phone. However, in Bénin (in West Africa) only 30% of the population lives in regions with any telecommunication system at all.

In this last case study we come closest to the ordinary user or consumer. In different terms, the translation process is now in a phase of "closure" or "stabilisation". This closure does not, however, imply that the technology is not reinterpreted. Reinterpretation takes place as still more user-groups are enrolled and by this the demand for a more elaborate user-interface. In the process of translation, we move from a stance with great emphasis on the lead-user to the growing importance of more ordinary consumers. However, the concepts of producer, user, and consumers may be deceiving and disguise the fact that even the last social groups enrolled in the growing user-group may reinterpret the technology and invent new user-values. By this process of reinterpretation the last social groups enrolled also create systems for communication, adding new user-values. When translating experience from industrialised countries to developing countries one could, of course, argue that the projects undertaken automatically imply a reinterpretation according to the diffusion of innovation model. The problem with many projects in technology transfer is, however, that they underestimate this reinterpretation process and perceive the transfer as a simple replication process. In the first phase of this project the necessity of reinventing the hybrid had not been

taken into account. However, it is the intention that this will be done in the second phase.

Need assessments may appear unnecessary in a situation in which needs seem so far from saturation as in Bénin. However, the fact that everybody “knows” the needs, makes it important to elaborate on the need problem in a context in which international and national authorities take the need for granted. How shall we penetrate the obvious and allow the needs of actors in a given setting to be described?

Shaping the Test Setting

The original frame of reference for the test setting was the rural people and their need for telecommunications. This first frame of reference was closely linked to the communist regime that fell from power in August 1990. When a more market oriented regime entered office, policies changed, which also affected the circumscription of the experimental projects. The setting was now defined by the need for modernisation of the economy, and the telecommunication system was perceived as a necessary tool to integrate the economy and for economic structural adjustment.

This shift in frame of reference was also a shift from a more or less technology-push strategy to a market-demand strategy. New telecommunication services were to be installed, first, at the places with the highest demand. While the first choice of test places was typically rural villages with a certain tourist image, the most obvious of these places was Ganvie, an exotic village on pillars in the shallow lacustrine. The new regime changed this and chose four quite different villages. These four villages have one thing in common, they represent nodal points in the general communication system. Demand is documented by the fact that the actual users pay for the installation costs by their use.

In the present frame of reference the authorities prefer to act as if need and demand are identical. This kind of strategy ensured success for the installations, but to the detriment of those who cannot translate their need into a market demand that covers both installation and operation costs. In this case we may therefore identify frames of references which hardly do meet at all and I will, with the concept “relevant social group”, explore the concept

of "need" and how different relevant social groups inscribe different user needs into the test setting.

Because of high costs and limited resources it has been important to study the "need"-problem in a frame of reference that insists on cost-effective solutions. *Community Tele Service Centres* have therefore been perceived as an important means of developing new models for rural telecommunications. So far, a fully equipped tele service centre in Cotonou has been established, while in Malanville, Djougou and Parakou we find community tele service centres at an early stage with some basic services, but with some of the planned services waiting to be installed. Kraké is still on the waiting list for transmission equipment. In the following I will first present the four locations (except for Cotonou, which is not that interesting in a rural context).

Kraké is situated 28 km East of Cotonou. It is also a border post to Nigeria and has a population of 2450 inhabitants according to the 1989 census. There are people there from Togo, Ghana, Niger, Nigeria and Mali. In the Kraké region, corn and manioc are the main crops and the main cash crop is copra. There is an important retail trade of manufactured products from Nigeria and this is a transit area for goods coming from and going to Nigeria. Concerning transport, there is an important traffic between Cotonou and Kraké and between Porto-Novo and Kraké. The administration of Kraké consists of one person from the village assisted by some counsellors. Kraké has a customs house, a police station and three primary schools. There is no electrical utility at Kraké. Besides the customs and the police who have a generating set, a few citizens also have small generating sets for lighting at night.

Kraké has no telecommunication equipment; the nearest telephone exchanges are those of Sèmè, approximately 12 km west by road, and at Porto-Novo; this latter is a parent exchange for Sèmè and is situated at approximately 13 km as the crow flies to the North-West of the locality. Several people commute to Porto-Novo and Cotonou and people express a great need for a better telephone service since the commuters and the traders have an extensive network of activities.

Malanville is a district in the province of Borgou and situated in the extreme north of Bénin along the river Niger. Malanville is a border town on the Niger river. It is the most direct and easiest passage point between the Niger

Republic and the Bénin Republic. Malanville is a town where one meets people from Niger, Nigeria, Mali, Burkina-Faso and Togo in addition to the people of Bénin. The population of the district is estimated at 35.000 inhabitants living in altogether 33 villages. The village of Malanville has approximately 12.000 inhabitants.

It is an area which produces millet, sorghum, selected potatoes bulbs and peanuts. Cattle and goats are raised, as well as fishing by line and net casting. Fishing is one of the main economic activities, and in the village there are 188 small fishing boats (pirogues) and 17 larger pirogues or ferries. Altogether, there are over 200 fishermen in the fishing village of Malanville. Malanville is an important trade area (food products and manufactured products). It is the terminus of public transport from Parakou and is also an important transit point for food products coming from Nigeria and Niger. Malanville has decentralised administrative structures at the level of a sub-prefecture, four basic schools and one general secondary school. The level of education is rather low; only about 20-30% of the population can read and write. The percentage of young people between 6 and 14 attending schools is 26% for boys and 16% for girls.

Malanville has a telephone exchange with a capacity of 300 lines, with 51 connected. Its parent exchange is Kandi to which it is linked by microwave. Malanville has one public telephone at the tele centre. The local exchange is power supplied by two 25 KVA generating sets and batteries. Because of a lack of tele services in the adjacent part of Niger, people even come over from Niger to make telephone calls.

Parakou is the capital of the province of Borgou and the main town in the North. As such it is a growing town, with a population of 90.000 inhabitants (1989 estimate). Apart from the convergence of various Bénin populations, the town has immigrants from Niger and Nigeria. In the areas around the town of Parakou the population cultivate corn, yam, millet, sorghum and fono. The cash crops are cotton and cashew. Herding is limited to cattle and goats. There is one factory for cotton ginning, two breweries, one textile factory and one ice cream factory. There is an important trade network for food products and manufactured products, but it is mostly retail trade (cloth, cosmetic products, etc.). Parakou is a cross-roads: the terminus of the railway line Cotonou-Parakou, and the starting point for heavy trucks taking goods

to Niger and Burkina-Faso. It is also the terminus for the heavy trucks that pick up cotton from the ginning factories and the cotton bales which will be carried by rail to Cotonou.

The town of Parakou has all the decentralised structures of the central government. It has several primary schools, three general secondary schools and one high school, a training school for nurses and assistant nurses and a combined training college for primary and secondary school teachers which is dependent on Bénin National University. Parakou has a fairly high level of education, over 80% of the population can read and write. The percentage of young people between 6 and 14 attending schools is 94% for boys and 70% for girls.

Parakou has a telephone exchange with a capacity of 1600 lines, at present 633 are connected and the local network is saturated at 98%. The town is linked to the main Bénin cities by microwaves. The tele centre of Parakou has three public telephones; one for coins and two for cards. There are ten telex subscribers in the town connected to the telex exchange of Cotonou by a harmonic telegraphy cabinet. The telecommunication equipment is supplied with power by the public distribution system backed up by a 32 KVA generating set.

Djougou is an important town and district in the province of Atacora not far from the border of Togo. The town of Djougou has a population of 45.000 inhabitants (1989 estimate). It has limited immigration of people from Nigeria, Mali and Burkina-Faso. In the areas around the town the population cultivate cotton, groundnuts, yam, manioc, corn, millet, rice and beans. Cattle and goats are raised. There is no industry in Djougou. Trade is quite lively with women retailers and a few wholesalers and retail/wholesalers. Transport could have been more developed but the state of the roads and of the tracks is poor. Nevertheless Djougou is an important cross-road between Niger, Togo and Burkina-Faso. Djougou is the second town of the Atacora province. Djougou has a median standard of education: 51-60% of the urban population and 31-40% of the rural population can read and write. The percentage of young people between 6 and 14 attending schools is 53% in the urban areas and 34% in the rural areas.

Djougou has a telephone exchange with a capacity of 200 lines, with at present 121 lines connected. This town is linked to the main cities of Bénin

by microwaves. The telecommunication equipment is supplied with power by the public distribution system backed up by a 25 KVA generating set. The tele centre of Djougou has one public telephone for coins and a telex-service.

Enrolling the Users

As in most developing countries the peasant is the backbone of economic life in Bénin and in the two northernmost provinces of Bénin, Borgou and Atacora, 80-90% of the approximately 1.4-1.5 million people are involved in agricultural production. The two provinces have 29% of the population yet in 1985 they had only 6,2% of the national telephone traffic. Among the users of public telephones only 1,9% were peasants.²²⁰

In the development and promotion of new tele services we can point to at least three different sets of actors:

- 1) The telecommunication industry and the marketing system
- 2) The national telecommunication companies and the introduction of new technology in the telecommunication sector
- 3) The end-users of the new services

The network supplier is the Office des Postes et Télécommunication (OPT). However the shaping of the network is a product of interaction between several actants. First of all we have the technology producers and the research and development actors. Since Bénin due to its colonial history is closely connected to France, the telecommunication network reflects this historic link, both because the emerging national state of Bénin inherited an already established network in 1960, but also because the main suppliers since independence have been French companies.

OPT is closely linked to these suppliers as part of OPT's training in skill and competence. Under these circumstances the aid agencies and the financial sources are important mediators, since the aid agencies and financial sources are part of the international system for technology transfer often closely linked to the donor countries' own policy for technological development.

As a frame of reference for national policy making, the international policy actors are the International Telecommunication Union (ITU) and the different

affiliated or related organisations. They are concerned with standardisation, research and development, but also handle questions of specific interest for developing countries. The Maitland commission mentioned earlier is a good example of this, and several of the more important points in the report of the Maitland commission, *The Missing Link*, are reflected in the Plan Directeur National des Télécommunications from OPT in 1986. This plan was also developed in co-operation with ITU agencies.

The technology is an important actant in the development of new technological solutions. However, in the case of countries like Bénin we are usually talking about ready made technology, and their actantial roles are here more apparent in user-producer relations in the production of *services*.

Altogether, this set of actants have established a communication inventory with different technological solutions mostly for voice communication in rural areas. However, from this inventory the service-producers and the service-users choose a specific repertoire. How this repertoire is shaped will be one of the main issues raised in the rest of this chapter. Three organisational solutions are the main elements in this repertoire; the private telephone, the public telephone booth and the tele commerce or the community tele service centre. How does this repertoire fit into the communication tasks of the communicator and the end-user? What is the feedback from these user-groups to the communication repertoire? How does the technology introduce strains and yet possibilities in the communication process?

One would imagine that these user-groups organised, to a certain degree, their own feed-back to the network suppliers. However this is seldom the case; either in Bénin, or in Norway. The most important feed-back is therefore in the direct user-producer relationship. However the telephone is the tool of the emerging society, in which the traders, the public servants and the long distance truckers are important user-groups. In fact it sometimes seems that the role of the public telephone booth is similar to that of the cellular telephone systems in the industrialised societies since 23% of the callers are only in transit, and 31,7% of all the telephone callers had a private telephone back home. This high percentage of private telephone owners is amazing in a region with only one telephone pr. 1300-1500 inhabitants. The four towns or villages studied had very few telephone lines in actual use, see figure 17



Figure 16 Map of Bénin²¹⁹

Town/village	Population	Telephone connections	Telex	Telefax
Parakou	90.000	633 (250)	10(5)	7
Djougou	45.000	121 (1)	1	
Malanville	12.000	51		
Kraké	2.450	0		

Figure 17 Communication technology in use (registered demand in brackets)

As mentioned the telephone is an important tool for the emerging elites and even when studying the public telephone we will find private telephone owners are an important user-group. This in contrast to what Samarajiva and Shields write:

The PCO or pay-phone technology is designed not for true two-way communication but for phoneless people to initiate communication with those who have residential or business phones. This fits perfectly into the asymmetric model of rural-urban communication implicit in government policy and academic writings.²²¹

Samarajiva and Shields focus on only one aspect of the public telephone, and the public telephone is certainly not the poor man's solution to long distance communication, since the largest social group, namely the peasants, hardly use the telephone.

The largest user-group of public telephones were the people involved in trading activities; they accounted for 37,4%. The next largest group were people working in the public sector which accounted for 27,2%, while transport counted for 13,6%, students 7,2%, private service sector 7,2% and industry&construction for 5,7%. These groups do not carry a telephone with them, so the greater the need for public telephone services. They are therefore important *social carriers* of telecommunication technology, promoting the need for a universal telephone service.²²² 53,2% of the telephone-calls are business-related calls, but even more telephone calls are closely linked to the callers' profession since truckers, public servants etc. call home e.g. to tell their family and friends when they are due home.

This heterogeneity between different user groups is similar to that Mowlana describes in his multidimensional and integrative approach to communication

utility.²²³ Large parts of the population communicate in traditional ways while a small group enjoys the possibility of using several different tele services and also other information technologies.

The Problem of Distance

In the national plan for telecommunications it is mentioned as a rule that “the telephone set will be installed in an area which has a high density of population. But it is preferable to choose the localities so that there will be at least one telephone set within a 10 km radius for most of the rural population”. For most people this is not the situation today. But, looking at the travelling distance for people actually calling from the tele centre, we find that only 14,6% of the telephone callers travel more than 10 km. See figure 18. Two interpretations of this fact may be given:

- 1) The public telephones are located in more “urban” areas and the use of these telephones reflects the more “modern” economy of those areas.
- 2) The cost of travelling is so high that people travelling for more than 10 km. try to limit their use of the telephone as much as possible.



<1 km;27,8%) 1-2 km;15,7%) 2-4 km;25,7%) 4-10 km;16,2%) >10 km;14,6%

Figure 18 Travelling distances for people travelling to make a call

However, when travelling to the tele centre at least 45,7% had experienced several times that the telephone or lines were not working or that reception was too bad.

In spite of the fact that the tele service centres studied are located in the three largest towns in northern Bénin, only 2,3% of the telephone calls were local calls. This is not surprising since the telephone density is very low and it is in fact not unusual to travel for long distances to make a telephone call. People even cross national borders like the people in Dosso in Niger who travel for 145 km. to Malanville to be able to telephone. The public telephone is therefore the tool for long-distance communication. 30,7% of the telephone

calls are calls within the region, 15,5% are calls to other regions while 30,7% are calls to Cotonou (the de facto capital) and 20,8% are calls to foreign countries. The map gives a more detailed picture, see figure 16.

The public telephone is then the tool of the emerging elites with fast-growing networks of contacts. But as such, it is an important tool and used frequently. 58,5% of the callers with private telephones use the public telephone twice or more per week, while only 35,9% of callers without phones use the public telephone twice or more per week.

In rural telephony the users face different problems and shape different solutions depending on the influence of different relevant social groups in shaping the telecommunication services. In the next section I will present some of the problems and solutions in rural telephony.

Inscribing Technology

Artifacts for human communication are as old as mankind: paintings, drums, smoke etc. are all examples. All these artifacts have their own language formed by human beings. Information and communication technology are, however, artifacts strongly integrated into the way of organising the communication setting. It is therefore not possible to understand telecommunications without understanding the social setting they are part of. Since I am primarily not looking for intrinsic qualities of the technology, I have to look for qualities that are linked to human communication as a social phenomenon. By analysing the hybridisation process we may therefore identify strategic elements in communication between actors. These elements may help us to understand the reasons for failures and successes in the development of telecommunication technology.

To understand the translation and reinterpretation process of new tele services in rural Africa we must identify the social carriers in the process. How do these social carriers organise their activities and what factors determine their use of tele services? When the case study took the form of a pre-test, it was to gather more systematic experience regarding the interplay between needs and solutions. The potential manufacturers also seek the co-operation of the users in the search-process, looking for "black spots" in their more or

less felt needs. Usability trials or tests with communication technology may also be looked upon as a test where not just the technology is tested, but also the users. This is because the manufacturers cannot be sure that the users will be able to do what is required of them. So “what is at issue in such tests is not so much the projection from “test” to “actual use” of the machine, but the projection from test to actual use of the *user!*”.²²⁴

Clusters of Relevant Social Groups

As most of the readers of this book, the people in the phoneless village of Kraké also want to delegate time-consuming travelling to the telephone. When choosing between delegation or long-distance travelling their first choice was to travel to the closest public telephone about 15 km. from the village. As their second choice they would send a letter. Only as the third choice would half of the people asked travel to the destination of the communication. However, even if the delegation has similarities, we may identify several relevant social groups around a single artifact as illustrated in figure 19.

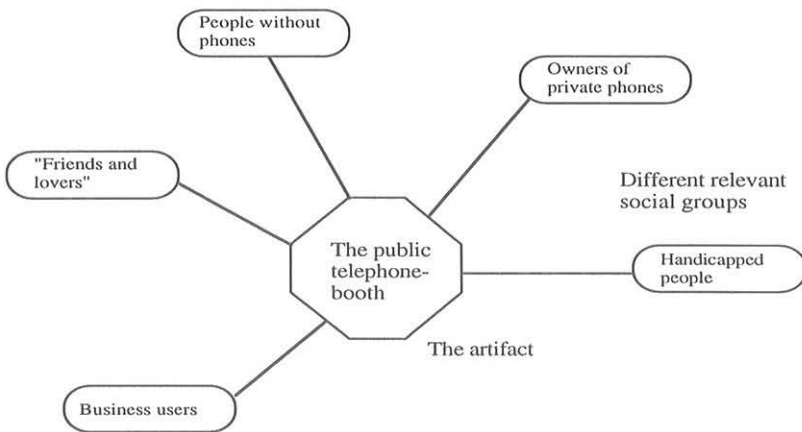


Figure 19 Clusters of relevant social groups around an artifact

The interface between a single artifact and the relevant social group varies greatly: or in other words there can be an enormous gap between the prescribed

user and the user-in-the-flesh. The public telephone booth has like all artifacts prescribed users. Many telephone booths in Bénin are elevated from ground level to prevent the water overflowing into the booth. Thereby the booths has a pre-inscription "telling" another non-human, the tropical rain and water, to keep out. Looking at this pre-inscription from the point of view of handicapped people depending on tricycles, the message may however be reinterpreted, telling the user that this telephone booth is not for handicapped people. Handicapped people may have great difficulties in entering a normal telephone booth. The problem is even greater when the telephone booth is elevated from the ground to prevent the rain, making small rivers in the streets, from pouring through it.

Experiencing this kind of crisis also allows the setting to be described; "if everything runs smoothly, even the very distinction between prescription and what the actor subscribes to is invisible because there is no gap, hence no crisis and no possible description".²²⁵ A more fundamental crisis than the shutting out of a specific social group is of course the crisis of artifacts out of order: "cabine en panne" ("The telephone booth is out of order") is not an uncommon experience. Here the crisis is absolute, the technology is "dead" and of no use. This kind of crisis illustrates also the technological alternatives or lack of alternatives. As the female head of Société Béninoise d'Electricité et d'Eau in Parakou said: "I am only 20 cm. from my telephone, but it does not work for a large part of my working-hours".

This problem was solved by a rather traditional solution, the use of a private courier-service. And the corporation used considerable resources on this activity, with an average of two to four courier-journeys per month to Cotonou from Parakou.

In fact the problem of linking up receiver and caller may be so great that some people prefer to use the radio for personal communication. Sound-broadcasting is the modern media that reaches most people and the estimated number of receivers in Bénin is 1.467.000. The sound-broadcasting network covers 100% of the country and on average broadcasts 9 hours per day.

The radio station in Parakou broadcasts regularly in seven different languages and every day they transmit about five private messages mostly concerning death in the family, marriage or other ceremonies. Such a message costs 1000 CFA²²⁶ and is always received by the people it is meant for. This

mode of transmitting messages is not far from the traditional drums, which mostly transmitted announcements and not private communications.

Actants Shaping the Communication System

The communication system is a product of actors, artifacts, nature and society. The artifact, the factual communication network, is therefore moulded by several groups of actants. Figure 20 illustrate some of these actants.

There are several technical solutions to the establishment of a physical telecommunication network. Here I will only stress some of the problems that influence the shaping of technology. First of all the climate is an important barrier; high temperature, humidity and heavy rain with strong devastating erosion and undermining of the lines are factors in favour of microwave links. An even more radical shift in the ways in which relevant social groups attribute various meanings to an artifact is illustrated in the vicinity of Kraké. Here the telephone wires have been stolen several times, not for communication, but as an artifact to be sold for its valuable copper.

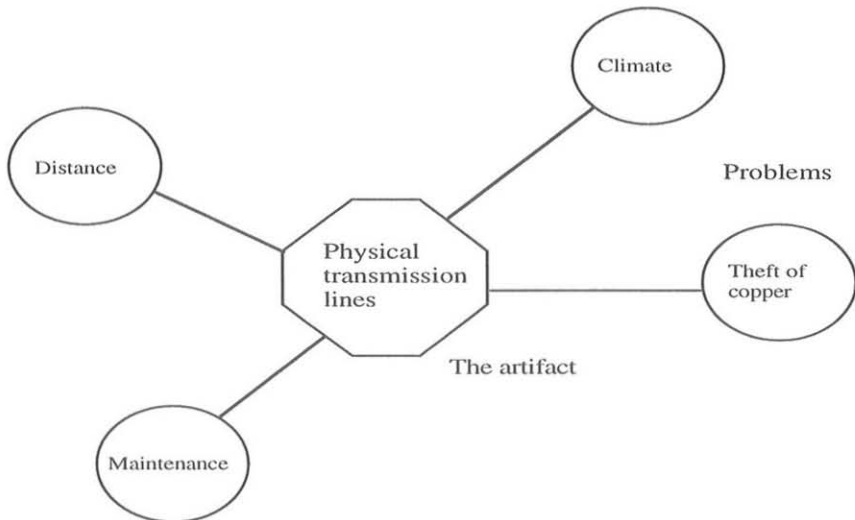


Figure 20 Actants shaping the transmission lines

Similar experiences are reported from other countries, among them South Africa, where crushing poverty and massive unemployment in the townships make telephone materials such as copper very tempting commodities to steal.²²⁷ In Kraké they have already experienced this problem because of high criminality on the border with Nigeria. Distance and maintenance are also important factors in favour of microwave links and the present transmission network comprises 1 431 km of microwave links and 1994 km of open wires of which 51% are still in use.

However, even if various social groups attribute various meaning to an artifact for communication it is also necessary to get a better understanding of how different social groups communicate with the help of artifacts. In studying the process of shaping, one has to identify the different user-groups and their perception of problems and solutions. As a starting point, we have taken it for granted that there is a growing need for long distance communication, a need no longer met by the traditional drums or runners. This need can be met either by the broadcasting system, the telecommunication network or the postal system. The drum and the storytellers are slowly replaced or supplemented by the broadcasting/television system, while the telecommunication network and the postal system replace or supplement different courier systems.

In many respects, the postal system satisfies a lot of the expressed need, and in Kraké, where there is no postal office, they stress the need for easy access to a post office as very important. As an example, in Djougou the post office handles about 40 outgoing letters and about the same number of incoming letters daily. They also handle telegrams and money orders, altogether about 200-300 pr. month.

Defining Problems and Solutions

However, only telecommunication makes possible synchronous dialogue and long distance two-way communication. In the case of oral communication there is of course the possibility of possessing a private telephone. So far private telephones are expensive both for the user and society. It is difficult to estimate how many people could afford a private telephone, but an estimate from Djougou states that about 1/3 of the households could afford to install and

pay for the usage of a telephone if they put a very high priority on telecommunications. However it is unlikely that there are that many households with this kind of priority, and the great majority of households will therefore for a long time to come be dependent on access to public telephones.

Still the waiting list for private telephones count more names than the number of already installed telephones. If people in spite of a long waiting list get a private telephone, that does not mean that all the user-problems will be solved. First of all there is the payment lag; the bills arrive two months after the telephone call has been made. Few users can be sure that they will always be able to pay their bills two months later.

Furthermore, in a society with very few telephones, both private and public, one can seldom look upon the private telephone as an exclusive communication tool for only personal use. Friends, neighbours, and family members will of course both ask for permission to receive and make calls from your telephone.

For every private telephone there is an average of 2,4 households in the neighbourhood that receive messages through that same phone. Borrowers making telephone calls are not that usual; only an average of 0,4 households in the vicinity are allowed to borrow the telephone to make their own calls. Most owners look upon this as a problem and try to regulate it in certain ways, and some of these regulations will in fact also include the owner. Such regulations are for example the blocking of outgoing long-distance telephone calls. An estimate by OPT-officials in Parakou is that about 3/4 of the telephones are affected by different restrictions on use.

In relation to traditional beliefs and values, the telephone will also be regarded with scepticism by certain users. They neither like the fact that neighbours or family members are able to communicate with non-present people nor the fact that this communication is private. Some owners of private telephones therefore dislike making calls from their own private telephone, since a lot of people will then know about the content of his or her communication and might try to harm the owner by destroying his or her activity or business (at least many think so). In addition the telephone is also used for calling girl friends or boy friends who are looked upon as competitors by other household members. This is also well known from the industrialised

countries where families especially in the past have been blamed more often than other institutions for violating the privacy of individuals.²²⁸

Hence a public telephone might be more private than a private telephone. This we discovered when doing our survey. A lot of people were very reluctant to part with private information and a lot of explanation had to be done to convince the caller that answering the questions would be of no harm for him or her. In spite of strong "selling" from the interviewers some refused to say where, why and whom they were calling for fear of later retaliation.

The scientist whose approach may indirectly provide the most clues to the impact of new media on psycho-social roles is the sociologist Ervin Goffman²²⁹. Goffman describes social life using the metaphors of drama. In the drama of life we play a multiplicity of roles on different stages. For each audience we offer a somewhat different role. Goffman suggests that any individual's behaviour in a given setting can be divided into two broad categories; a) back region or *back-stage* and b) *front-stage* or on-stage behaviour. In front-stage, the performers are in the presence of their audience in a particular role. Back-stage are areas to rethink and analyse, and to develop strategies for future performance in the front-stage.

New telecommunication services complicate the attributes of front-stage and back-stage. We may have increased accessibility, invasion of privacy etc. The relationship between front-stage and back-stage are therefore highly dependent on the social setting. However, different social factors determine whether one is acting front-stage or back-stage.

In Norway a telephone call in your own home will usually be part of your back-stage activity. In Bénin, however, a telephone call in your home often belongs to your front-stage activities. To ensure the necessary privacy you may then use a public telephone for more private calls.²³⁰ Since a lot of people feel they have the right to use your telephone, your ability to pay for a fast rising telephone bill will force you to define the receiving and making of telephone-calls differently; and also ensure some use of the telephone for back-stage by closing the outgoing telephone-line or using a locking device on the telephone dial.

Meyrowitz elaborates on the concepts of back-stage and front-stage and by this he make a useful distinction between the forefront of the back-stage (the less personal or less discrediting information) and the deep back-stage

(the more damaging information). Electronic media have made the forefront of the backstage more public.²³¹ The relevant social group, the private telephone-owner, therefore defines a set of problems looking for solutions. See figure 21.

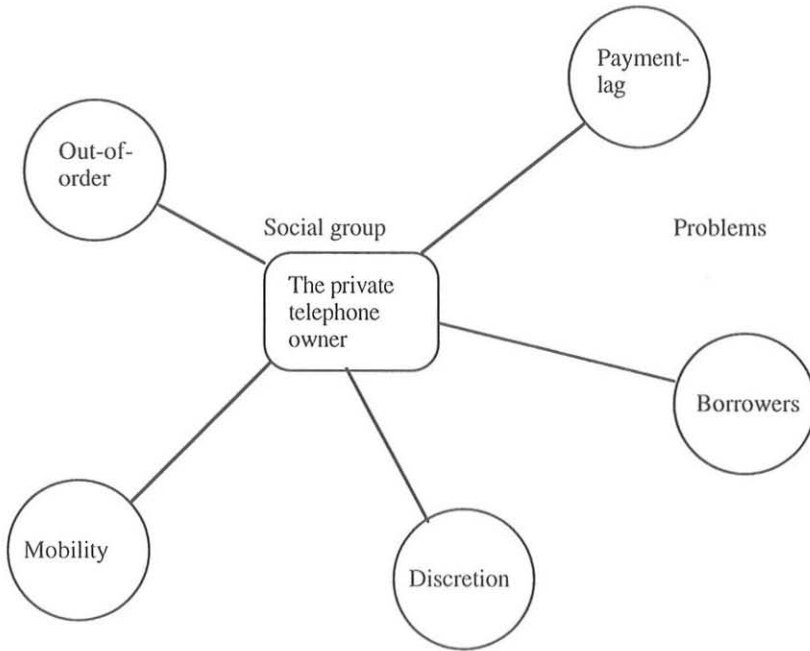


Figure 21 The private telephone owner and perceived problems

The private telephone in the Northern provinces of Bénin is a fairly new communication tool. 21,8% of the people interviewed had got their telephone between 1979-84, 49,1 % between 1985-89, and 29,1% in the years 1990 to 92. People that are able to own a private or business telephone are often well off people that also travel a lot, mostly in relation with their work. They are therefore not always able to use their own telephone and are therefore

potentially an important user group of public telephones. And of course the private telephone might be out of order for different reasons, so that the owner will depend on the public telephone.

Among the people having access to their own private telephone 78% had imposed different restrictions on its use, either by physically closing the telephones or by blocking long-distance telephone communication. In most households the private telephone is therefore more in use for incoming telephone calls than for outgoing, and 54% of the private telephone owners use the public telephone fairly often for one reason or another.

Most potential telephone users, both for private and professional use, do not have a telephone but depend on the public telephone for making telephone calls. A public pay telephone has been installed in Parakou, Malanville and Djougou. Just recently two public card telephones have been installed in Parakou. The users of public telephones are mainly middle-aged men. 83,4% of the users were men while 16,6% were women and 92,4% of the users are between 20-49 years with the 30-39 age group as the largest user-group with 45,1%.

The social groups using public telephones for coins may have solved some problems (if they are private telephone owners!), but the solution is a point of departure for new problems. See figure 22.

First of all we have the problem of the value of the coins. The largest coin is a 100 CFA. For 100 CFA it is only possible to make a local call. The average call throughout Bénin (except for Cotonou) costs 780 CFA, the average call for Cotonou cost 1160, and the average call abroad costs 2700 CFA. The maximum cost was a telephone call billed for 14600 CFA, which is a lot of coins. Most telephone callers are aware of the new technology which makes it possible to use prepaid cards, and they would strongly prefer a "card telephone". When asked what kind of public telephone they would choose if they got an extra one, 80% said a card telephone, while 50% preferred a coin telephone. Besides the problem of carrying a lot of coins, the coins are of course a tempting target for robbery and thereby destruction of the telephone booth. Furthermore, not all coins are accepted by the system and the coin teller sometimes "eats" the coins without delivering the necessary service.

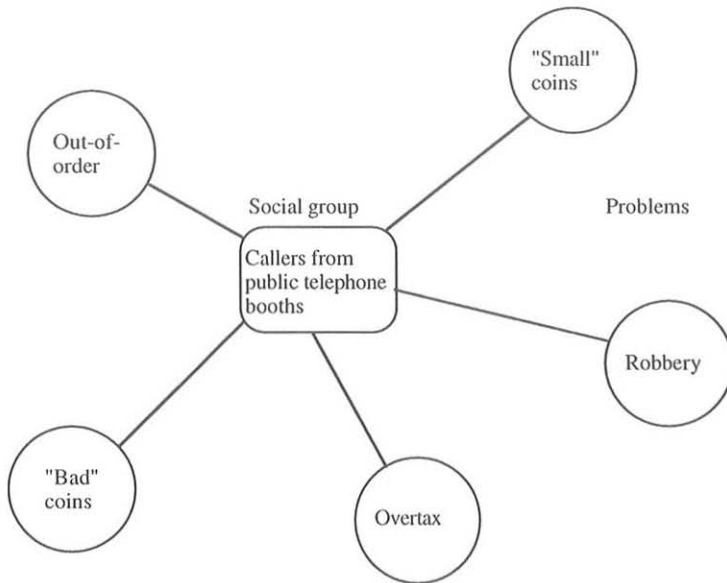


Figure 22 Callers from public telephones and perceived problems

For different reasons, the public telephone may be out of order. This has especially been the problem in Djougou. When one is lucky enough to find a public telephone that works, the next problem is of course to reach your business associates, family or friends who do not possess a private telephone. An estimate is that between 30% and 50% of all telephone calls were not primarily to the person called. It could either be a personal message to your wife about your arrival or situation, but going through an other family member or friend or it could be a more general message concerning all relatives as in the case of death in the family. To handle some of these calls the receiver had to fetch the callers' family etc. But certainly not in all the cases, since that would be both impractical and expensive.

The receiver of the telephone call is therefore an information-node in the community, transmitting a lot of messages. The main problem with this is

the problem of discretion, since as mentioned before not all people want to deliver their messages even through friends and family members. A possible solution considered by the International Association of Community Tele Service Centres is an organised message-system, and 48% of the people asked would like such a solution even if it did not fully solve the discretion problem.

With new communication technology it is also possible to transmit written communication through the telecommunication network. So far the telex is an old and well known system in this respect. It is mostly larger businesses that prefer the electronic transmission of written text. For example, in Parakou, the seven transport companies taking care of transport from Parakou to Niger and also other places in the northern provinces are long time users of the telex- and also the telefax service. And they also sell this service to their customers and the smaller merchants in the neighbourhood.

The problem with the telex is that the interface is not that user friendly and flexible. Asked to choose between the telex and the telefax, 34% preferred a telex-machine while 52% preferred the telefax. As already mentioned, Parakou, as a centre for communication, has a stable user-group of electronic text-transmission, but in Djougou, for example, OPT estimates that there are only about ten potential users of telex- or telefax service, in addition to people in transit. Telex-transmission from Djougou is, therefore, very seldom in use.

The different telecommunication services also involve some equipment and services. The local population looks upon these services more or less as part of the modern communication system as a whole. The typewriter, the roneo, the copy-machine and the personal computer are examples in this respect. In Djougou, with 45.000 people, the parish priest is the only man that possesses a copy machine. When his machine is out of order one has to travel 150 km. - three or four hours in a bush-taxi at a cost of 1200 CFA - to get a photocopy in Parakou, where about 20 commercial enterprises compete in the market for photo-copies. In comparison Malanville has only one copy-shop. The copy-shops also type business letters, applications for their customers, etc.

The personal computer is still a rather infrequent tool in use in the northern region and very few people express a need for access to a personal computer. In fact the personal computer was the information or communication tool

that most people said they were in no need of. While 17% said they found the personal computer useful, 72% said they did not know and 11% said explicitly that they did not want it. Experience with personal computers is limited and only Parakou has one or two companies selling equipment and computer services. However, if we look closer at the technology we will find that the installation of a specific artifact "demands" certain competencies from the users. One example is of course the ability to read and write. Even if one can manage to make a telephone call without these competencies, they give you an important advantage.

Without the ability to read and write you will need a broker to translate and communicate the message for you. Among the users of public telephones 8,4% had education of three years or less, 22,7% had four to six years of education, 31,5% had seven to ten, 16,7% had eleven to twelve, and 29,7% had thirteen or more years. Even if the telephone is a fairly easy technology to handle, not all user-groups are familiar with it. Several users therefore need assistance to interpret the technology and its possibilities in their own terms. A large user-study in France concluded that 39% prefer spoken messages to messages displayed on distributors or in telephone booths.²³² As France is a fairly literate society one can only imagine the problems in countries with a much lower literacy rate and thereby less competence in interpreting written instructions.

To summarise, the testing of needs consists of a mapping of both "observed" and "felt" needs in the collision between users, problems and opportunities. Linking needs, problems and solutions it may be possible to present a picture of the users and their "observed" and "felt" needs in rural telecommunications. See figure 23. These results were presented to the Office des Postes et Telecommunication and The International Association of Community Tele Service Centres (IACTSC), for further development of the experimental projects.

The political changes that took place from 1989 to 1990 in Bénin did influence as mentioned the selection of local communities for pilot studies. In the beginning three communities were selected for pilot studies; Ganvie, Adjarrá and Come. These communities were close to the objectives of IACTSC. During 1990 there was a stronger shift towards a market economy together with marked changes in the bureaucracy of OPT and the

telecommunication department got a new General Director. In this situation the OPT put a stronger emphasis on the economic base for new tele services in the selected communities and four quite different communities were selected. In other words there was a shift from problems articulated in the technogram to problems articulated in the sociogram.

By this change of strategy OPT preferred to restrict further experimentation to well known technology, mainly testing or monitoring different applications ('allies' from the technogram), including user-values and the frequency and direction of communication (interests in the sociogram). This was not in opposition to IACTSC's program of action, however. For the transferability of experience they would also like to test more unusual applications, like computers.

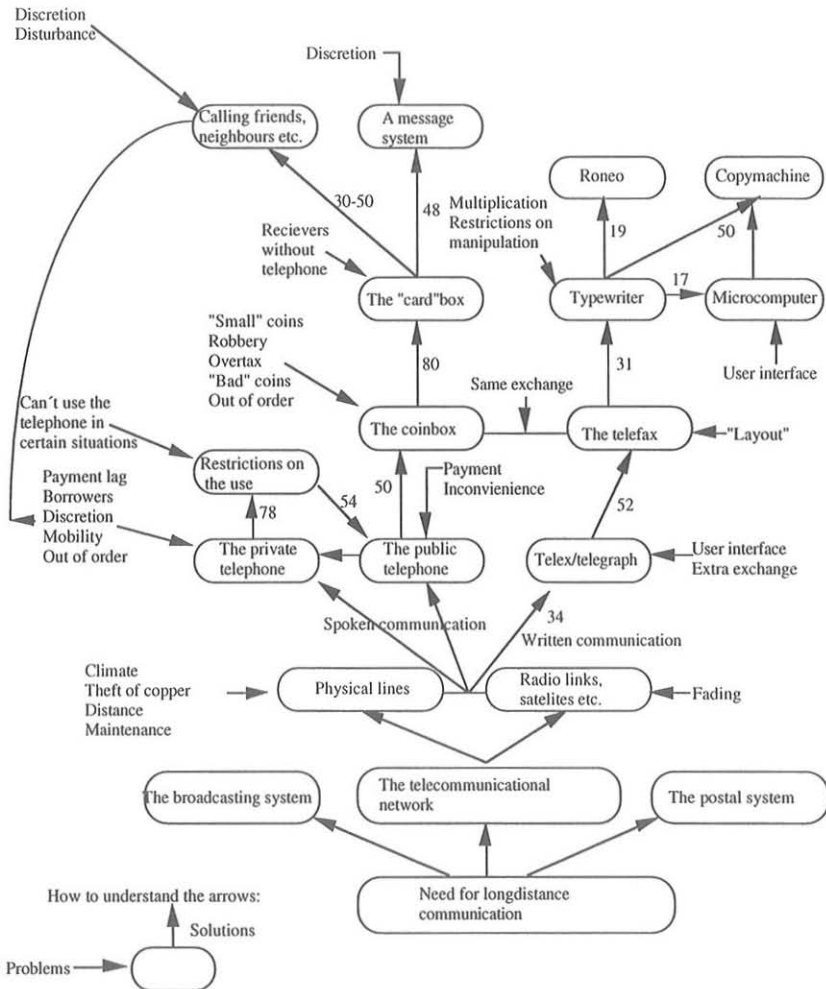


Figure 23 Needs, problems and opportunities in rural tele services²³³

Inscribing the Test

In demand-pull strategies the needs are situated in "reality" and imported into the hybrid community, to both improve knowledge about the perceived need for communication technology and the interface between the users and the technology. How the service-producer defines the problems is partly shaped by the perception of who are the dominant social group of users.

As discussed earlier, the technological solution sought, such as the public card-telephone, is framed by the prescribed user being professional users making long distance telephone calls. This social group consist mainly of traders, public servants and transporters. As this group is important in economic and social development in Bénin it is not surprising that their needs are given priority. However, other groups like handicapped people, illiterate users, etc. are in need of a better user interface. This user interface may be improved by the full establishment of community tele service centres, with better access and better guidance.

The *hybridisation process* of different user-groups is seldom a field for conscious policy activities in most countries. Some critical writers like Neil Postman and others choose more or less to reject modern information and communication technology and promote "back to basics". Technological progress, and television in particular, have been made responsible for all the evils in modern society. In the field of policy this is hardly a fruitful analysis, either in the industrial countries (or post industrial if anything like it exists), or in the developing countries.

However, it is necessary to draw attention to a behavioural trend which is becoming more and more pronounced; namely the trend towards individualism. Not only mass media, but also telecommunications or on-demand communications, are part of a transition from one type of society to another, which underlies and embraces all the individual changes in behaviour patterns.

The distribution of information among economic actors is reflected in their access to the different elements in the sociogram and the technogram: if we accept that economic development depends on a communication repertoire characterised by a) variation and b) complementarity. For the single mainstream actor it is not enough to master a wide communication repertoire

if it has a very low degree of complementarity. In his article about *The Myths and Realities of the "Information Age"* Mowlana tries to give a conceptual framework to communication utility, see figure 24.

As illustrated in figure 24 a given society or a country may reflect at both individual and nation-state levels any combination of traditions of communication systems and technology, and some may be stronger and more dominant than others at any time and at any level, depending on social, cultural, political, and economic conditions. In developing countries, economic activities are mainly organised in local production and employment systems, as in the Northern provinces of Bénin where about 80-90% of the population are peasants. Inscribed in the technology of telecommunications one finds a mode of integrating society that primarily reflects the mode of production of industrial society. Among the users of public telephones only 1,9% were peasants, which among other things indicates a strong orientation towards the local information system with little "need" for telecommunication technology.

If one therefore looks at the different sectors and use communication as the main indicator one will find that the construction, industry and service sector are all examples of sectors with a stronger regional economic integration, while the transport sector is more or less split between a regional and a national/international production system. Employees that take part in national or international production and employment systems may have high mobility. Oil exploitation in Bénin and Norway illustrates this clearly.

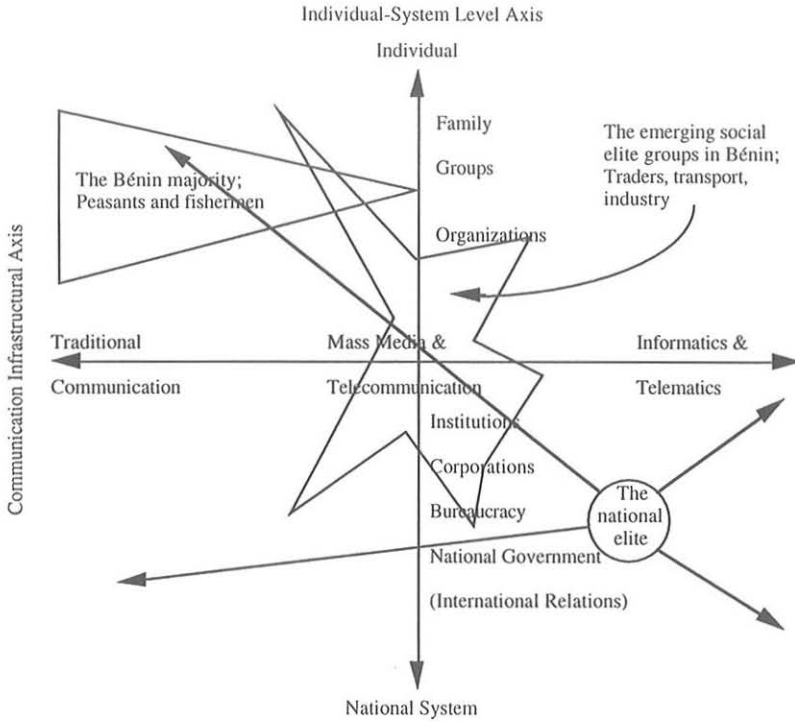


Figure 24 Multidimensional approach to communication utility²³⁴

However, in Bénin, the trading and transport sector is the most recognised national production and employment system and has in fact important international links. Among the professional telephone calls to Cotonou from Northern Bénin, 63% were linked to the trading/transport sector, while 32,6% were linked to the public sector. Looking at the international links, the trading/transport sector accounted for 84,6%, while 7,7% were linked to the public sector. In fact, the trading and transport sector is strongly interlinked and the

sector constitutes the only important national production and employment system apart from the public sector.

When communication patterns evolve quite differently among different user-groups, enormous information and communication gaps may develop. These information and communication gaps are therefore not only a reflection of unequal access to important resources, but also an important indicator of unequal social involvement. While large parts of the population in Bénin still ascribe to values belonging to the local community, the coming elite and the middle class are taking important steps into a large scale society. In doing so they are changing patterns of behaviour, giving priority to individualism and entrepreneurial activities. In many respects these values are supported by the activities of national and international authorities. However, even if these "new" values may seem important in the transition from a "traditional" to a "modern" society, it is important to make linkages between different value systems, and different systems of communications.

At a smaller scale, at the level of a tele centre, it has been perceived important to strengthen the tele centres ability to train and educate quite different groups of users in the field of communication; not only by putting emphasis on advanced technological solutions, but by trying to blend old and new patterns of communication. The message-system is an example of this. One important aim, however, will be to improve the possibilities for communication inside the local community or the local info-communicational system.

The hybridisation process among different user-groups is not only shaped by the arriving technology, but also by an active involvement in the life of society. In this respect the community tele service centre has been perceived to be something more than only a place filled up with new communication technology.

In an analysis of how information and communication technologies shape society, and thereby also reflect changes in the sociogram, Katz²³⁵ has found three different phases of shaping. In the first stage of state building, information technologies are mainly used by the state apparatus. Thus the political variable (and the network of international influence) has more weight than the economic variable in determining their diffusion. In the second phase, which we might call "infrastructure building for economic development" communications development is driven by economic needs, mediated by the

political system. In the third phase - that of "maturity" - as a result of the industrialisation process, the manufacturing and service sectors become the main contributors to the expansion of information and communication systems. In this phase, the economic variable is the one that has more weight and the private sector tends to develop a conflictive relationship with the regulatory structures of the state. Technological developments limits the government's capability to enforce the control of diffusion of technologies.

This is an historical model and can not be adapted to the developing countries without modifications. While the model represents a more or less unilinear development for the industrialised countries, the developing countries experience a more multilinear development and the different phases are more or less contemporaneous. The relationship between economic and political variables is therefore much more complicated.

In Bénin, as in most developing countries, the telecommunication network and services will in general be a governmental or public domain both as to policy and ownership. Even if some private companies as a commercial sideline sell telephone-, telex- or telefax services it has not been the International Association of Community Tele Service Centres' main concern to stimulate privatisation processes. At the same time some of the more peripheral services mentioned in figure 23 have traditionally been the responsibility of private enterprise. However, in further experimentation different solutions at different places will be tested, either by stimulating private enterprises to take up this line of activity, or by including them in the community tele service centre.

Testing users' needs entails both an understanding of the heterogeneity of user groups and how these user groups participate in the overall matrix of society. As already mentioned, the test setting in Bénin was redesigned in an early phase of the project giving emphasis to a more prudent approach that involved the targeting of new technologies and services to those parts of the market for services where demand was relatively proven.

This shift to a demand-pull driven technology strategy ensured the success of the project, but also illustrated the weak negotiating power of groups not belonging to those markets. Moreover, the enrolment of user groups representing the strongest demand entailed not only consequences for geographical distribution, but had also implications for user groups in the same geographical area not enrolled in the main user groups. These user groups

could include illiterate persons, handicapped persons or simply people without telephones. A successful satisfaction of the needs of those groups should include other solutions than the solutions already enrolled.

The underlying aim of the user-value driven hybrid community was to give the policy-makers, and not the least the decision-makers, a room for thought, but also a test-bed for action. The results of this aim may be found in recent decisions in the International Telecommunication Union. At the American Regional Telecommunication Development Conference they "resolve ... that the tasks and functions of the BDT Regional Telecommunications Program for Rural Areas and Low-Income Strata shall be ... to promote the experimental introduction in the Region of Community Tele Service Centres or similar structures, in rural areas and in low-income urban areas, and to evaluate their use and social, economic and cultural impact..."²³⁶ In 1994 this was extended by the World Telecommunication Development Conference, where it was proposed to start a world-wide project and establish 1260 Community Tele Service Centres in a pilot phase.²³⁷

9. Framing Technology and Tests - Selection and Salience

The Inscription-Translation-Reinterpretation Process

In David Lodge's novel, *Small World*²³⁸, the newcomer to academia, Persse, is confronted with academic life and its ambitions and disappointments. At his first conference he is introduced to Felix Skinner, the publisher's representative, and when he is asked about his research in front of his colleagues he suddenly realises that it is boring. His original thesis, on the influence of Shakespeare on T.S. Eliot, is a very traditional way of framing the problem, and on the spur of the moment he turns it round and reframes the problem as the influence of T.S. Eliot on Shakespeare. This reframing catches the interest of the publisher and the puzzled surprise of his new colleagues. This kind of reframing makes the difference between "crashing" into open doors, and gaining new insight.

However, our creativity in problem solving is not just dependent on our "limited" imagination, but is also framed by limitations. As social actors we participate in social encounters and these encounters entail different sets of rules. These rules are clustered in frames. While the framing of tests is essential to the understanding of how tests are constituted, the framing of actors is essential to the understanding of how actors are introduced to tests, participate in tests and finally mediate their experience. Translation of interests between different groups of actors is therefore essential to understand how they relate or are conscripted into a setting. Persse was recruited or enrolled into the "Small World" of academia by a case of mistaken identity, and similar examples of coincidence may be found in the case of technology testing. However, when people suddenly find themselves in a situation of negotiations between different interests they usually start to participate in the definition of a relevant setting by constructing programs of action or antiprograms.

The research community has been slow to appreciate the most valuable findings available from the field findings that derive from this complexity. Elton was therefore able to demonstrate that the paradigm used for generalising

from laboratory studies was dangerously limited.²³⁹ When one is testing a specific solution and treating this solution as an isolated event, one is assuming that the only decision variable is the modality of a specific technological solution. This assumption also implies that technologies, as artifacts, are rather static entities and until about the mid-1970s, it was assumed that an innovation was an invariant quality that was not changed as it diffused.²⁴⁰

The discovery of innovation as a process implying reinterpretation or reinvention is therefore a relatively recent discovery, and the translation model tries to come to grips with this dynamic aspect. Hence it is important to understand innovation as an ongoing process of translation. Innovations are reinterpreted or reinvented. Callon outlines the way that the translation of innovations may pass through four stages, during which the identities of actors, the possibility of interaction and the margins of manoeuvre are negotiated and delimited:

- 1) Problematization or how to become indispensable
 - a) The interdefinition of the actors
 - b) The definitions of obligatory passage points
- 2) The devices of "interessement" or how the allies are locked into place
- 3) How to define and co-ordinate the roles: enrolment
- 4) The mobilisation of allies: spokespersons as representatives

For hybrid communities I would add a fifth stage that is important for the understanding of the final outcome of the experiment:

- 5) The resolution and closure of the hybrid community

In this final chapter I will use the four case studies to elaborate on the process of problematization, enrolment and closure.

Problematization

In the first "moment" of translation the initiators - be they researchers, politicians, or local entrepreneurs - attempt to impose their definitions of problematic issues both on the test setting and on other actors. Characteristic of the problematic issues so defined is that they also define the aims of the test at the very point of departure. In the introduction I referred to the four case studies as:

- 1) The explorative experiment
- 2) The pilot experiment

3) The demonstration experiment

4) The replication experiment

This way of framing the test settings, defined what the initiators intended to achieve when the tests were planned. However, although the initiators intend to define the aim of the experiments *it is not that easy to become indispensable*. Two problems makes a stable definition of problematic issues difficult. The first one is not mentioned by Callon in his original article, but it is nevertheless, usually very important in the hybrid communities I am discussing: *the spokespersons as a continuously changing group of actors*. In hybrid communities one very seldom finds that spokespersons are a stable group of actors from the beginning to the end.

Hybrid communities as quasi-experiments are, as a rule, part of a larger framework of policy. Policy actors are therefore not the same persons as those defining the experiments. Nor are those defining the experiments necessarily the same persons that carry them out. One will therefore find a relay race of actor groups; each actor group running part of the distance and handing the baton to the next actor group. However, contrary to a normal relay race, the group taking over the baton has a certain freedom to make their own interpretation and translation of what kind of race they are in and where the finishing line is. By this process of changing spokespersons they not only have to enrol other actor groups as allies, they also have to enrol new spokespersons. In this chain of spokespersons, there are not only continuous translations but power is also both shared and delegated through this chain.

The role of telecommunication technology was defined in two ways: a) as a network for communication and by this b) as a facilitator of new services and applications. If the new network did not facilitate the development of new services and applications the researchers had a fundamental problem. These types of critical problems constituted and defined the different obligatory passage points. To be able to enrol the necessary allies for the passage of the obligatory passage point the technique of double or multiple framing evolved.²⁴¹

The first case study was perceived as an R&D driven case at a very explorative stage of technological development. As such I defined it in the introduction as a case normally perceived as situated in the beginning of the diffusion process and therefore oriented towards the innovative users. This

does not entail that the research project was not interested a priori in the refusal and the rejection of new technology by “non-innovative” users. However, if this were be the final result the whole strategy of creating hybrid communities would be at stake. To ensure at least the possibility of success efforts are therefore made to recruit “lead-users”.

The next case study, the local development driven experiment, was perceived as a pilot experiment and, as such, more oriented towards the early adopters. The telematic centre already existed as a “social invention”. The framing of the “social invention” was, however, not perceived as satisfactorily for the diffusion of the invention. In the next case study, I therefore described how the “social invention” was reframed in a local development setting. In this case study too, one can see a chain of translations taking place from the national policy authorities, to the researchers and finally to the local actors. However, contrary to the explorative experiment where the leading actor group was the researchers, in the pilot experiment the leading actor group was the local development workers.

The first obligatory passage point defined was the passage point of “local development”. However, I identified a path leading to the definition of a more specified obligatory passage point, that of “local development with the help of new communication technology”. This more specific obligatory passage point was further spelled out as “local development with the help of telework”. The feedback from the hybrid community later led to a redefinition of this last passage point to “transaction costs as a decisive factor”. By this succession of obligatory passage points, escalating the problem to be solved, one has the choice of either locking one’s allies into place around the reinterpreted passage point or reinterpreting this last passage point as a point not fit for passage (at the moment).

Several of the field experiments accepted this last reinterpretation and reoriented the field experiment towards the local market. By turning attention towards the local market, the importance of technology (especially communication technology) was made less relevant, while local knowledge, local skill, local networks were made more relevant. This shift in attention led to a reopening of the black-box: “test telematic centre”. If technology was less relevant, then alternative organisational solutions could be made more relevant. Why not establish private firms, subcontractors or even homeworkers?

To illustrate this process of negotiation and translation, I have linked case one and two and, by some examples, illustrated the translations that take place and the implications of these translations (See figure 25). The figure does not encompass all translations, but a more simplified version of some of the more important ones.

The first translation is interpreted as a test of the use of fibre optic cables. By this translation the researchers promoted "inside" recruitment of new allies like PVC-pipes, switches and amplifiers, and not least everything necessary to facilitate the efficient transport of the laser beam through the fibre optic cables. In the second translation, attention is reoriented towards "outside" recruitment of interests primarily in the form of "user needs" and a "need assessment" was made to identify the services which should be implemented. In the third translation the "need assessment" was interpreted as an indication that some "needs" existed. However, all were "small" needs that did not entail the "need" for a fibre optic cable, but the need to solve many small communication problems. The third translation led therefore to a reorientation of the problematic issue, as being along the interface of the technogram and the sociogram. How could problematic communication problems that could profit from new technology be solved, when each of the communication problems was too small to be solved by investments in expensive new technology? This reorientation of the problem led to the fourth translation and thereby the "social invention" of the "telematic centre" (or hybrid) aimed at solving all these small communication problems.

Case two, the pilot experiment, took the idea of the telematic centre, but adapted the idea to different rural or regional settings. The fifth translation implied therefore a reinterpretation of the telematic centre more towards the sociogram and "outside" recruitment of interests primarily in the form of "local development". However, to promote local development the promotion of new jobs was important, and the sixth translation transposed "test telecottage" into "test telework". This sixth translation tried to promote "inside" recruitment of new allies, like different versions of electronic communication and videotex. The later reinterpretation argued that the telecottages needed experience with telework to be able to improve the confidence of the market and thereby the sales of "services conducted as telework". The seventh translation moved the test towards outside recruitment of interests in the

national market. Later experience on the national market and the high transaction costs for services produced as telework gave way to a reinterpretation and the eighth translation involved testing the local market, and thereby “outside” recruitment of interests like the local municipality and local industry. This return to the local market made the idea of the “telecottage” questionable and gave way to the idea, the ninth translation, that these economic activities could best be solved by small private firms, subcontractors or even homeworkers.

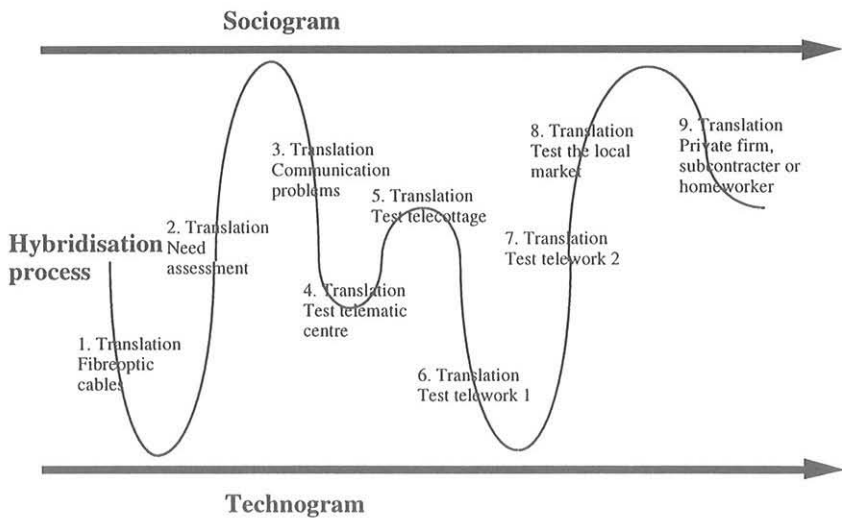


Figure 25 The translation process in testing

The third case, that of testing a more specific solution for a well-defined target group, defined Norsk Data computers as its obligatory passage point. This flagship of Norwegian industry created an organisation for R&D that would both utilise Norwegian computer technology and by this also promote Norwegian computer technology among Norwegian industry.

However, when the computers stood virtually idle in the new R&D centres the initiators defined five more specific "markets" that needed computer expertise; one of them represented by the Travel-FUNN consortium. The researchers assigned to the Travel-FUNN had, on taking over this baton, to combine the demand for market orientation with the demand for outlining an information system. They therefore tried to define the issue as the need for an "Information- and booking system". However they never succeeded in mobilising support for this interpretation, and ended up with an obligatory passage point defined by the "lead user" which caused problems of commitment even for the researchers.

In the last case study the problematization of the test setting was settled in an early stage of the project. Making the shift in frame of reference, a shift from a technology-push strategy to a market-demand strategy, moved the obligatory passage to "user need". However, only needs that could be translated into demands at a very early stage of the hybrid community were to be included in the experiment.

In his case study of the scallops of St. Brieuc, Callon established a framework for the study of innovations. However, the study of hybrid communities indicates that the process of problematization is rather difficult when none of the actors have a fixed position. Callon asks a single question - does *Pecten maximus* anchor? - and even if this question involves many possibilities and solutions, it is still possible to keep the question as the guideline throughout the study.

In hybrid communities the guideline is far more negotiable and the problem of stabilising a single research problematic is very difficult. However, the case studies indicate a development, from the very open ended and explorative case of the "Telematic Sandbox" to the very user oriented case study of Bénin. At the beginning of the innovation process it is most difficult to define a common obligatory passage point while later in the "diffusion process" this is much easier. Although, in the last case study, we are dealing with well known technology, the users try to reinvent and reinterpret the technology to make it fit their needs as these are presently defined.

How the Allies are Locked into Place - Enrolment

According to the translation model, the structure and operation of an actor-network involves an interrelated set of entities that have been successfully translated or enrolled by an actor. He or she is thereby able to deploy their strength and speak or act on behalf or with the support of the actor-network. Enrolment is the definition and distribution of roles. However, roles are not fixed and pre-established, nor are they necessarily successfully imposed.

To describe enrolment it is thus necessary to describe the negotiations, trials and strengths that accompany the enrolment process and enable the process to succeed. The arrangement of the negotiations may differ between different categories of hybrid communities. However, four categories of strategies may be identified among the four case studies: to integrate, regulate, persuade or inform. All the four experiments may involve a different mix of these four strategies. In figure 26 I indicate the dominant strategy.

Spokespersons enrol allies and try to build associations of artifacts and facts to promote the aim of the test. However, spokespersons behave differently depending on their frame of reference and the frame of reference of the participants in the hybrid communities. In the four case studies, I have described trials that represent different combinations of frames of reference. The frame of reference of the experimenters and the participants may either be that of "technology-push" or "demand-pull". Enrolling allies among the social actors requires a strategy of decision-making that enables the pursuit of a common obligatory passage point.

The method by which an actor-network group arrives at its final decision is a function of the amount of time available, the history of the actor-network, the kind of task being worked on, and the kind of climate the actor-network group wants to establish. Callon speaks of weak co-ordination when he seeks to characterise a network which has no specifically local rules. He speaks of strong co-ordination when he refers to a network shaped by both local and general rules.²⁴² However, the rules are part of more overall decision-making strategies. I will therefore use the strategies outlined by Pace and Boren to elaborate on the problem of co-ordination and enrolment: decisions by bypass, power, coalition, majority, plurality, consensus or unanimity.²⁴³ Different

combinations of frames of reference result in different strategies of enrolment as outlined in figure 26.

		Experimenters' frame of reference	
		Technology push	Demand pull
Participants' frame of reference	Technology push	1. <i>Integrate</i> Spokespersons enrol by coalition, consensus or unanimity	2. <i>Regulate</i> Spokespersons enrol by bypass
	Demand pull	3. <i>Persuade</i> Spokespersons enrol by power	4. <i>Inform</i> Spokespersons enrol by plurality or majority

Figure 26 Different strategies of enrolment

In all the four experiments we find that the strategies change during the process, as the spokespersons and the circumstances change. However, in all the experiments we find one of the four strategies shown in figure 26 that has been more decisive for the outcome of the test than the other strategies.

In the explorative experiment, the hybrid community was framed as technology push (see square 1). The aim of the technology push did however differ, be it either technology development or local development. In hybrid communities such as the explorative experiment, the spokespersons tried to enrol support by building coalitions, seeking consensus or, infrequently, by unanimous decisions.

In the pilot experiment the policy-makers, as the original spokespersons, framed the hybrid community as demand-pull, while the local participants initially framed it as a technology-push experiment (see square 2). The spokespersons in square 2 employed an evasive strategy, making decisions through bypass i.e. ideas were continuously suggested until the local participants decided to adopt one of them. In the pilot experiment, the original spokespersons were mostly interested in a policy output, but afraid of long-term public commitment. They therefore let the actor-network explore the different options and only supplied general guidelines for the activity.

In the demonstration experiment, the original spokespersons framed the hybrid community as a technology-push experiment, while the participants (both the researchers and the final users of the system) preferred to frame it as demand-pull experiment (see square 3). Thereby the original spokespersons used their power to either decide alone or to endorse preferred suggestions. Later the researchers and the final users started to betray the experiment as they did not see the need for the technology, while the original spokespersons betrayed the experiment when the obligatory passage point they had endorsed (i.e. the Norsk Data machines), were not suitable for passage.

In the replication experiment, both the spokespersons and the participants framed the hybrid community as demand-pull, and the strategy employed to enrol allies was either by majority decision (i.e. a majority of the users) or plurality (i.e. the greatest possible number of users) (see square 4).

Hybridisation

Hybrid communities consist of associations whose strengths depend on the successful “outside” recruitment of interests in the sociogram and the “inside” recruitment of new allies in the technogram. The results of this study indicate that “outside” recruitment of interests in the sociogram dominate when the hybrid communities are delineated as technology push driven by important actor groups. First in demand pull driven experiments does the “inside” recruitment of new allies, in the technogram, dominate. With this discussion of different user groups and their enrolment into tests I have tried to enter the lives and worlds of users (and producers) so they could talk on their own terms and in the contexts of their own lives. I ascribe to Dervin’s critique of

user studies, that users in many of these type of studies emerge as fairly mythological inventions of researchers.²⁴⁴ The enrolment of the different kind of participants indicates some of the anticipated participation and how the participants are expected both to produce results and valuable experience. Frames in this respect refer to the codes of conduct by which various participants organise their social experiences. Hence an important question is how the participants organise their experience and mediate it to other people.

Participants organise their experience according to their own frame of reference. Moreover, institutions or organisations also organise and learn from experience, and in many respects this was the main focus in most of the evaluation projects. Some experience and learning are outside of the original frame, since people learn and experience something quite different than intended. In the actual tests the experience of the participants was the “raw material” that the evaluators were to base their evaluation on. Yet, was this raw material really appreciated?

According to the translation model

“the spread in time and space of anything - claims, orders, artefacts, goods - is in the hands of people; each of these people may act in many different ways, letting the token drop, or modifying it, or deflecting it, or betraying it, or adding to it, or appropriating it. The faithful transmission of, for instance, an order by a large number of people is a rarity in such a model and if it occurs it requires explanation”.²⁴⁵

The translation model is therefore a model that emphasizes the importance of understanding continuous transformation. In this model, the testing of technology represents a process of controlling and promoting the inscription-translation-reinterpretation process, so that images become facts for a growing number of enrolled relevant social groups. However, evaluating the “success” or “failure” of an inscription process is not that easy, since the inscription process in a specific test setting may be part of a larger inscription process taking place in the realm of policy formulation and politics.

In the first part of this chapter I have therefore analysed the inscription-translation-reinterpretation process in the hybrid communities. In the second part of this chapter I will analyse the translation process of the “laboratory experience” into policy and practice.

Framing the Test Setting - Translating Experience

In technological development the combinations of user-values in the sociogram and the technogram are conditional on the development of a larger technological inventory. Inside an analytical framework several sub-frames may be identified. Two sub-frames are of most relevance to the analysis of testing²⁴⁶: 1) assembling frames, which are something like nets dredging the data from the diversity and variety of materials in the social world. An assembling frame in a test situation may differ between different actor groups, but also differ between different test situations, and 2) interpretative frames that organise the facts gathered. There are three different elements to an explanation of the process of interpretative framing: the event (and system and units involved), the interpretative frame for the events (or a series of events), and the outcomes. In the case of a test situation, the event could be called "the test". The frames available could be: the "success", the "failure" or the "retest" frame. The outcome is the range of different implementation options including full implementation, partial implementation or rejection. The linkage between the available frame and the outcome depends on the translation of the results.

Shifting between Frames

Different actor-network groups may frame their participation differently, and not only seek experience according to their chosen frame, but may also submit their own experience to other actors in quite a different frame. By shifting out of their own frame of meaning, and shifting into another frame to transmit the experience, we the audience, experience the problem that testers inscribe the traits in the users which they depart to test and that the users ascribe to the testers definition of the "problem" (e.g. "experimenter expectancy effect" and the Hawthorne effect). A complete solution of this problem is probably not possible. But I will elaborate first on some implications and later on some possibilities.

Hybrid communities constitute a partial or "artificial" reality trying to imitate reality in a fairly controlled way, while keeping a distance from the real world. By this, inevitably, not only the technology is put to test but also

the actors participating in tests are tested. Yet, the testing of actors evolves partly from the attention by IT-producers devoted to the problem of the users. As a user of information technology, together with a lot of others, I have experienced the development from punch card technology to the development of a Macintosh user interface disseminating to all personal computers.

This emergence of a new range of microcomputers entails the definition, delineation and emergence of *the user* or in Woolgar's words:

"We could say that this process amounts to the (social) construction of the user. However, it is not just the identity of the user which is constructed. For along with negotiations over who the user might be, comes a set of design (and other) activities, which attempt to define and delimit the user's possible actions. Consequently, it is better to say that by setting parameters for the user's actions, the evolving machine effectively attempts to configure the user."²⁴⁷

Inside the hybrid communities we will therefore find a variety of examples of how not only the technology but the users are tested. An unintended consequence is that the *test also illustrates how the same actors shift between different frames of reference in their attempts to create meaning, knowledge and, not least, influence the outcome of the test.*

My first attempt was to explore the social construction of the reader or user. When Woolgar reports from the usability trial he participated in, he underlines the fact that the user was expected to participate with 1) his or her ignorance (or innocence) as such, 2) his or her ignorance as representation of the preferred variation, to achieve information about the influence of a variety of circumstances and finally 3) his or her ability to keep the knowledge from the testing secret. An important part of the competence was therefore the naïveté of the user.

As already discussed, this was not an important part of the hybrid communities discussed here; to the contrary. In the hybrid communities it was important to use relevant knowledge actively in the shaping of technology. Moreover, the participants were not recruited on the basis of a certain variation representing the "typical" user, but more as innovative users or for their ability to act as lead users. Lastly secrecy was not desirable, rather the ability to

participate in the "marketing" of both ideas for use and of course the technology as such.

As a footnote, I think we here see an important difference between a private company (as in Woolgar's case) and a public monopoly (as Telenor some years ago). One reinterpretation of my earlier claim, that the hybrid communities were part of a technology push program, while today's demand pull strategy may prevent the application of large scale hybrid communities, could therefore be that it is privatisation that creates obstacles to an extensive use of hybrid communities. Privatisation increases the importance of secrecy, which is difficult to maintain in an open hybrid community. In the hybrid communities discussed in this book secrecy was usually unimportant and the participants were strategically enrolled to ensure the success of the experiments. However, the growing importance of secrecy may give priority to usability trials to the detriment of large scale "open" hybrid communities.

The process of framing is an ongoing process. Some constellations of frames are more important than others since they may build on conflicting or competing aims in the experiments without really solving the problem.

Only in the Jevnaker project is it possible to say that the outcome of the test did not originally depend on the commercial success of the project. However, as explained earlier, precisely this very open ended way of testing created contradictions in the definition of the setting. As Goffman has underlined, in order to use the term "key" unreservedly, "it must be assumed that the participants in the activity - experimenter, subjects (when there are any), and the scientific audience - all share the same appreciation of what it is that is happening while it is happening, namely, an experiment of a particular kind".²⁴⁸

This was not the situation in the Jevnaker project. While the experimenters defined it as a explorative experiment testing new technology, the local groups of participants defined it differently: the most important definition being the understanding of the setting as a development project for the benefit of the local community.

With a very open recruitment of participants this controversy was, if not inevitable, very likely. We have two strong actor groups with quite different frames of reference, and with very few possibilities for a meaningful translation. The solution to this problem could, of course, be that the experimenters

forced their frame of meaning onto the setting. The result of the informal "negotiations" was, nevertheless, a compromise. The compromise resulted in the coexistence of two frames of reference, the double framing evolved as a result and the sustainability of the compromise was ensured by framing the various test activities differently.

The pilot experiment involved double framing of partly conflicting activities. This double framing created problems very similar to what Bateson called a 'double bind' - the double bind is a situation "in which no matter what a person does, he can't win".²⁴⁹ For the experimenters the double bind creates trouble since the participants in the test no longer perceive it as a test, and will use their energy not to create experience relevant for the testing, but to promote his or her frame of meaning onto the test. For the participants the double bind creates trouble since the audience or the market perceives it as a test, and as a test is something different from reality, they will not treat the resultant "business enterprises" as real business enterprises in the market.

The double framing was therefore an important factor in preventing the emerging business enterprises from succeeding in the market, and finally they had to close simultaneously with the closure of the more overall policy project. For the local participants involved, the easiest solution was to break the original frame of reference, and to transform their new skills into new careers. By this translation they managed to ensure a more coherent single framing of their activities.

While the double framing of the explorative experiment evolved by decision strategies of coalition or consensus, the double framing of the pilot experiment evolved by decision strategies of bypass. In the demonstration experiment the double framing of the situation evolved when the mentors of the program wanted to promote specific technological solutions, while the research centres, in the long run, had to survive in the market. This situation changed again when, during the process, the steering committee developed a more strict framing of the setting than originally intended. Abandoning the frame of "technology-push" and shifting into a frame of "demand-pull" they still perceived the market as the final success criterion but shortened the period allocated to achieve success.

If everything is kept constant, except the period to achieve success, the original setting of the experiment will be crucially important. Since these

experiments took place in regions where, by definition, it was difficult to achieve success, the result was obvious. This may be contrasted with the testing of needs in Bénin. When the overall strategy changed, they also changed the settings for the project, making it possible to achieve the desired results inside the new relevant frame of reference.

This discussion of how actors participate in an ongoing interpretation process is conditional to the understanding of how hybrid communities find their resolution and closure.

Resolution and Closure of Hybrid Communities

Double frames do not only characterise test settings, but also actors participating in the tests. The continuum of producers and users involved in the production and use of information technology, results in changing definitions of who are the users and who are the producers. Not only do we find conflicts between different frames of reference in the definition of a problem, but we also find conflicting use of frames when it comes to the resolution of hybrid communities.

The most common conflict is found in the shifting in and out of assembling frames and interpretation frames. How does one resolve the conflicts caused by different framing and thereby reach a common understanding of the final outcome of the experiment?

In the study of the four cases we find that, when the experimenters' frames of reference are delineated by "technology push", they will render non epistemic factors of their own participation more important. Maybe the money for experimenting is getting less or changes in policy influence the interest of the experimenters. Furthermore, when the participants' frames of reference are delineated by "technology push", they will render non epistemic factors of their own participation more important. Examples may be the creation of hope for local development in the community or political goodwill that influence the participants' definition of their interests.

These non epistemic factors provide the actors with divergent negotiation power and/or motivation which first and foremost may result in prolongation of experiments as part of the negotiation process. However, all experiments will usually change in composition and aim if they are prolonged. They will

either be organisations with a different purpose than experimentation, or they will take on board new experimental activity. This last result is prevalent and the reason why Arbo has called successive recreation of new experimental activity for a symptom of "refeudalisation".²⁵⁰ However, the four case studies represent different strategies of closure. See figure 27.

		Experimenters' frame of reference	
		Technology push	Demand pull
Participants' frame of reference	Technology push	1. Prolongation and/or negotiations (or natural death)	2. Prolongation and/or transformation or natural death
	Demand pull	3. Procedural and transformation or natural death	4. Acceptance or rejection

Figure 27 Different strategies of resolution and closure

In the explorative experiment (square 1) the test of the social invention was one important reason for the extension of the experiment. The local participants wanted an outcome that could improve the employment possibilities of the local community, while the experimenters among other things wanted to explore solutions that could be useful to small rural communities. In the pilot experiment (square 2) the experiment was also extended by the test of telework. Later the local field experiments either died

a natural death or the activity and/or experiences were transferred or transformed into other institutional settings. In the demonstration experiment (square 3) the overall experiment ended with procedural decisions, some of the FUNN-centres ended by natural death and some of them continued as private firms. In the replication experiment (square 4) many of the potential customers adopted the technology and the most important threat to the new organisational set-up will be a better saturation of telephone lines for private and commercial use.

How do we understand the experience gained from "social laboratories" and how do we translate this experience into practice?

Translating Laboratory Experience

Experiences with hybrid communities during the past 30 years have led to two fundamental discoveries. First, that the anticipated results from hybrid communities were difficult to achieve. Second, that technology policy is not primarily founded on experience with hybrid communities, but is experimental in its very nature, and hybrid communities should thereby be looked upon as an active part of technology policy.

In the introduction I made the claim that the linkage between the "social laboratory" and "social reality" reflects the use of different policy strategies in the shaping of telecommunication technology. In strategies that from the producers' point of view may be delineated as "technology-push", the strategy entails the creation of a new reality in the laboratory and the export of the experience derived from the experimentation to social reality.

In strategies that from the producers' point of view may be delineated as "demand-pull", the strategy entails the import of a partial social reality into the laboratory, and through the experiments the reality is slightly changed and the experience is exported back into social reality. I claimed that the two strategies of "technology-push" and "demand-pull" were not opposing strategies, but counterparts in a more overall strategy emphasizing the importance of laboratory experience.

In this book, four specific test situations are described; explorative, pilot, demonstration and replication experiments. Hybrid communities with new information and communication technologies constitute therefore a family

which displays a certain degree of internal diversity. First of all, what is at stake in their program of action varies. Certain hybrid communities aim to promote new services so as to render the whole sector more competitive. This is the case with experiments like the Telematic Sandbox. Others take up challenges that are both economic and political, and thereby aim to promote a more overall development. This is the case with experiments such as those aiming at local or industrial development. Others again take up challenges that are both economic and political, but aim to promote increased participation in development. This is the case with the user-value driven experiment.

The hybrid community as a test bed for innovations depends on the existence of close interactions between the worlds of science, technology and the marketplace. By promoting interaction in hybrid communities one tries to define problems and shape solutions. However, one knows only to a very limited degree what the problem really is, or to use Weick's words:

The revolution (the so-called computer revolution) is an ideal exhibit of confidence as strategy. The revolution is as much vendor-driven as it is need-driven. The revolution can be viewed as solutions in search of problems people never knew they had. Vendors had more forcefulness, confidence, and focus than did their customers, who had only a vague feeling that things were not running right, although they could not say why. Vendors defined the unease as a clear problem in control and information distribution, a definition that was no worse than any other diagnosis available.²⁵¹

However, instead of leaving the outcome to the market I have in this study explored different strategies that aim to "invent" possible processes in the market. In the policy reports discussed in chapter 4 there is a predisposition to suggest experimental activity. There are several reasons for this and in many respects the period between about 1960 and 1990 was a golden period of experimentation in Norwegian policy in general. This is especially true in the field of regional and rural development; there was a long debate on how to improve the quality of life in rural and remote areas.²⁵² These values were incorporated in national policy later on and they dominated the rhetoric of Norwegian regional policy for a long period and still do.

One important consequence for policy actions may be seen in a strong predisposition for different kinds of "push"-programs. In retrospect we see

that intentions and results in hybrid communities often mismatch. Or to quote Mathisen:

“Maybe we are doing something else than we say that we are doing, and maybe the results are others than intended. If so, the total rationality of our enterprise - the relation between reasons, actions and results - is at stake”
253

In the translation model the negotiations take place between interests defined on the one hand in the sociogram (‘outside’ recruitment of interests), and on the other hand in the technogram (‘inside’ recruitment of new allies). The described case studies portray that when one sets out to test technology within a strategy of technology-push one ends up by testing the capacity to recruit ‘outside’ interests.

A counterintuitive claim may therefore be made: technology push-strategies are the strategies “least” concerned with technology as such. Furthermore when one sets out to test technology within a strategy of demand-pull one ends up testing the ability for ‘inside’ recruitment of new allies. The next counterintuitive claim is therefore : demand-pull strategies are the strategies “most” concerned with technology as such. See figure 28.

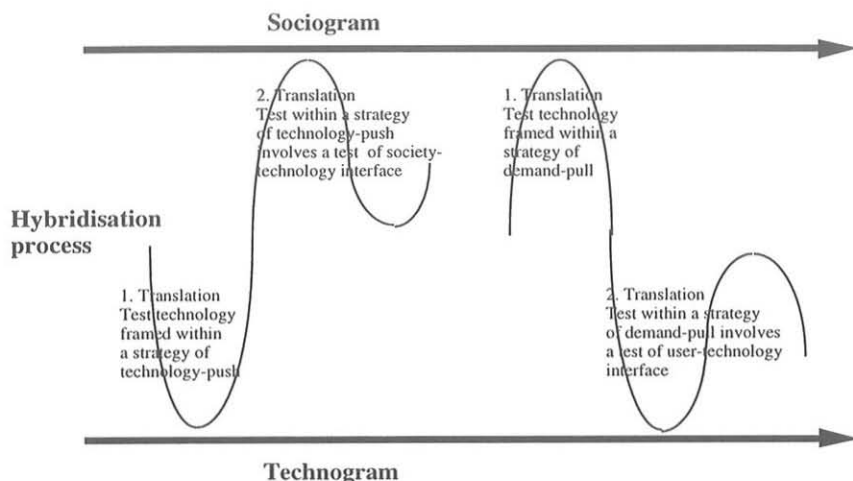


Figure 28 The translation process of tests

With this paradox in mind I will summarise how experience is translated into policy and practice.

Hybrid Communities and Beyond

The discussion of how actors participate in an ongoing interpretation process is conditional on the understanding of how hybrid communities find their resolution and closure. How is the experience gained from hybrid communities understood and how is this experience translated into policy and practice? At the outset I set out to explore this question and it seems that hybrid communities include the expectations of the experimenters and the participants, novel and traditional technology and last, but not least, they include a variety of experiences that are *interpreted* by the actors *for different purposes*. Furthermore, the hybrid communities described in this book were situated at different stages of the diffusion process.

The problem created by this linkage to the diffusion of innovation model was discussed in a more general manner. The close link to this model might mislead experimental activity. Although I will claim that this is true, it seems that some of the problems experienced in hybrid communities derive from the fact that the logic of the diffusion of innovation model is not built into the experimental setting. Hybrid communities, that at the outset should be exploring the social relations of information and telecommunication technology, are treated as if they can both solve employment problems and enhance the attraction of the local community in general.

By different translation strategies the participants "corrupt" the logic of the diffusion of innovation model, and the logic of the model itself is an object for translation. How did the different experiments described in the case studies fulfil their anticipated role, how was this role translated by the different actors and finally what do these translations teach us about the role of hybrid communities in technology policy?

Explorative experiments are risky ventures that seldom provide immediate returns or quick visible results. Their most important benefits derive from the acquisition of knowledge. According to Rondinelli they help us to define problems, or more useful ways of coping with the problem of "needs", exploring different possibilities for interventions and finally show how experiments at a later stage should be operated.

The most characteristic feature of explorative experiments is therefore assumed to be their usefulness at a very early stage of learning: when we know the least about all the possible implications and by experimentation enhance our knowledge and thereby lower the risk of innovating. This was certainly the aim when Telenor set out to build their first more complex hybrid community at Jevnaker. However, to enrol support from the local actors they took on board new problems such as "How is it possible to use new telecommunication technology to promote local industry and employment?". Interesting and relevant problems. But problems that shifted the aim of the experimental activity from the very explorative stage of the diffusion of innovation model to a later stage more concerned with implementation.

The most important feature of the explorative experiment should be to initiate a learning process about "hybridisation" possibilities. How do different communication technologies and the users constitute new forms of "hybrids",

and what might the social implications of such a direction of the hybridisation process be? Three different roles of the hybrid community were identified in the explorative experiment:

1. The first role focused on *problem definition*. The telematic sandbox wanted to achieve a better knowledge of how to define the problematic issues; not delimiting the objectives to already predefined issues. Although technology was an important part of the experiment, it was not necessarily the answer to all kinds of problem. The problematic part of this role derives, as already mentioned, from the fact that this role also makes the hybrid community very open and thereby vulnerable to problems defined in other frames than the original "explorative" frame of reference. Very open experiments may easily be corrupted by the translation of problems from more "explorative" frames of reference to more "action" oriented frames of reference.
2. The second role focused on the *unknown*. The telematic sandbox looked for solutions to problems or problems for solutions that were only partially defined. At the very outset of the experiment, they possessed some very strong technological solutions; such as the fibre optic cables with all the technology involved. However, the knowledge of how to use this technology in real life was limited and the experimental activity aimed at a better understanding of the different elements that constituted both problems and solutions.
3. The third role focused on how to find the most effective means of attaining *objectives* that were already well defined. An important objective was to improve employment possibilities among Telenor's own employees. The market for cable TV transmission was perceived as an interesting possibility to achieve this objective. However, this possibility was later perceived as being less interesting because of the development of satellite technology.

Since the telematic sandbox was a pioneering experiment, considerable resources were used and the project was prolonged until late 1991. The time problem was therefore less urgent than in some of the later experiments. However, the most important lesson, is that explorative experiments need protection in this very early stage of innovation (I am not assuming that all kind of explorative experiments deserve protection). There will always be pressures to conclude them if they are perceived as mistakes, or to replicate or enlarge their scope all too quickly when they are perceived as successes. Political pressure to translate them prematurely into pilot or demonstration experiments

are therefore one of the main threats (seen from the perspective of the diffusion of innovation model).

The local development driven experiment was designed to serve as a pilot experiment, raising public and industrial awareness, stimulating debate and especially for the purpose of re-thinking policy options. According to Rondinelli, pilot experiments can perform important functions: they can test the applicability of innovations in places with conditions similar to those under which the more explorative experiments were performed; they can test the feasibility and acceptability of innovations in new environments; and they can extend an innovation's range of proven feasibility beyond the explorative experimental stage. In this case there is a direct link between the explorative experimental stage and the pilot stage. In hindsight one may of course discuss whether the "social invention" was prematurely translated from the exploratory stage to the pilot stage.

However, at that time very few actors made such a claim. The most important feature of the pilot experiment was to initiate a learning process about the use of the "hybrid". How do the new "social inventions" or "hybrids" extend the possibilities for problem solving and communication, and how do they find their role within the overall matrix of society? Two different roles were identified in the pilot experiment:

1. The first role focused on policy
2. The second role focused on local development.

The first role may be identified as "experimentation for the sake of policy", not primarily as part of policy. For that reason the national actors were mostly interested in a relevant policy outcome, be it in favour of the local participants or not. This attitude meant that the national actors took a rather passive role when crises occurred in the local pilot experiments. The second role may be identified as "how to develop the local community with the help of new technology". By this delimitation the technology was by definition the "tool" to be explored. This focus on technology as the solution to more or less unidentified problems may of course be useful from the point of view of the experimenter. However, it may have diverted local attention away from more obvious solutions. Both the roles of policy and local development were

therefore in the interest of the learning process of external actors, not local actors.

The industrial development driven experiment was a demonstration project aimed to show that new technologies, and new information systems were better than the old ones because they increased the quality of the product, and thereby could deliver services more efficiently. The main purpose of demonstration projects is to show potential adopters how they may benefit from the innovations. Thus, although demonstration projects may evolve from explorative experiments and pilot projects they might also be designed to promote the adoption of a specific innovation. At this stage too a certain risk is involved. One of the more important ones, especially taking into consideration the fact that this was not the first attempt to promote innovation in this specific field, is linked to setbacks created by possible failures. Success is therefore even more important than in the two earlier phases, since a failure in the two earlier phases, is one of the very predictable outcomes. However, although demonstration experiments are more concerned with the predicted degree of success, they may also involve a high level of risk.

To achieve the predicted success of the demonstration, the projects are guided by a set of principles. First they must offer low risks for the participants. In the industrial development driven experiment this was ensured by strategies for the enrolment of all important national actors. Furthermore, they thought they had a rather good knowledge of the possibilities, since they could build on the experience of several earlier failures. Secondly, the project makers tried to make the benefits of the new information system visible for the potential users. However at this point they had problems with the users since it was unclear how the costs of the system should be met.

As a demonstration experiment, the AURORA project failed to enrol the most important users. If these strategic users had been enrolled earlier in the project it is likely that they would have promoted technological solutions better adapted to their problems or needs. This special system was also highly dependant on installed base or "critical mass". Adopting a technology push strategy, highly dependent on the installed base, requires considerable resources and a certain amount of patience. As it turned out the FUNN program lacked both the resources and the patience.

The user-value driven experiment was assumed to be a typical replication or dissemination experiments. This kind of experiment tries to disseminate tested methods, techniques or models through replication, full-scale implementation of a service delivery system. This is the final stage in an experimental series. For telecommunications the major contribution of these experiments is to expand communication capacity. Basic design problems include those of testing full-scale communication systems, developing appropriate and effective distribution systems and transferring the communication system to agencies that can manage them on a larger scale. Furthermore, replication or dissemination systems include the enrolment of new user groups by adapting the communication system to an increasing range of user-needs.

One important problem in transferring experience from explorative experiments, pilot and demonstration experiments into large-scale communication systems is the assumption that they can be transferred to new social circumstances without further testing or adaptation (except for the problem of running a full scale system, which is the rationale behind the replication experiment). Even if the model of CTSC was tested in other countries it was important to test the model in Bénin too. By the act of testing one need to enrol support from actors that later are going to manage the system. In this respect the test procedure is an important part of local learning and the transfer of technology.

In Bénin it was therefore perceived important to co-operate extensively with the local Telecom operator, as they would be the operator of the communication system later on. By implementing more typical replication or dissemination experiments in new social settings one also facilitates the reinvention or reinterpretation process, and thereby makes local adaptation more easy. In the case study I have described how the translations make transparent that the experiment is framed by the prescribed user being professional users making long-distance telephone calls. By this translation one experiences enormous gaps between the prescribed user and the actual user.

I have in this study tried to enter the lives of hybrid communities and tried to understand how they are constituted and are given roles in a more

overall framework of technology policy. The research problem have been studied on three interrelated levels:

- 1) At the level of actors and artifacts. At this level I have described how participants continuously make translations of their needs, their participation and of the artifacts. Different relevant social groups dispose of different possibilities for translation depending on the dominant frames of the activity.
- 2) At the level of hybrid communities. At this level I have described how different scenarios of technology development influence the perception of technological possibilities among producers, policy makers and end users. On this level too we show how frames guide the translation process.
- 3) At the level of policy and practice. Not only are the artifacts translated, but the experiments too. This implies that there is a strong "push" towards the end of the diffusion curve where technology becomes indispensable. By this "push" the logic of the different experimental stages is easily corrupted.

I have substantiated the central postulate that innovations in hybrid communities can better be explained by the translation model than by the diffusion of innovation model. Two questions remain to be asked. What is the role of hybrid communities in future technology policy? and Do we need alternatives to the current range of hybrid communities in technology policy?

The first question seems easier to answer as one already can detect some of the changes. Large scale field experiments have lost some of their attractions: both because the actors involved felt that the learning process was extremely expensive, but also because the growing tendency in the telecommunication sector to privatise has increased the importance of secrecy and short term profit. Alternatives such as "usability trials", "pre-market"-testing and small scale introduction of new products aimed at devoted users, are, therefore, favoured. However, the important part of the answer lead automatically to the second question.

In this book I started out by arranging the case studies according to the diffusion of innovation model. The main argument has been that even when one tries to situate hybrid communities along the diffusion curve, reinterpretations and translation of interests always take place. What therefore at the outset was defined as a specific type of experiment takes on board problems that render the original definition of the experiment pretty

meaningless. Instead of looking for alternative categories of hybrid communities it is therefore important to recognise that the experimental nature of hybrid communities not only include the experimental activities inside the hybrid community, but also the constitution of the hybrid community itself.

This “double process” of experimentation will easily corrupt both the experiment and the results of the same experiment. It is therefore important to recognise explicitly the aims of the experimental activity as well as the constitutional structures of the hybrid community. Finding new ways of establishing conditions that allow hybrid communities to recognise and cope effectively with the inevitable complexity of ongoing translations without corrupting the ultimate aim of the hybrid community will therefore be one of the strongest challenges for the use of hybrid communities in technology policy and innovation studies.

Notes

Chapter 1:

1. The concept "hybrid community" will be explained later in the introduction. However, the concept replaces problematic concepts such as "social experiments", "field trials", "social laboratories", etc. Problematic for two reasons; 1) some of them are closely linked to the idea of "science laboratories" and 2) some of them are closely linked to the "diffusion of innovation" model. Other scholars have argued that the functions of scientific disciplines have to a growing extent been usurped by multi-disciplinary groups of scientists or what they have called "hybrid communities". See van den Daele et al, "*The political direction of scientific development*" and Blume, "*Insight and Industry; On the Dynamics of Technological Change in Medicine*"
2. Cook and Campbell use the notion quasi-experiment for experimental situations in which the experimenter can't manipulate human behaviour. See Cook and Campell, "*Quasi-Experimentation*"
3. According to Bijker a "relevant social group" is both an actor and an analytical category. When following the actors in their identifications, definitions, and delineations, it is the actors' relevant social groups that we get. The central claim in the social construction of technology is that these relevant social groups are also relevant for the analysts. Hence "relevant social group" is also an analytical concept. See Bijker, "The Social Construction of Fluorescent Lighting", p. 78
4. As one of the strongest promoters of the modernisation paradigm Rostow describes in his theory of the stages of economic growth the S-shaped growth pattern of take-off, rapid growth with the "drive to maturity" and slower growth with the "age of high mass-consumption" and standardisation. Rostow's thinking is therefore quite similar to what one finds in diffusion theory. See Rostow, "*The Stages of Economic Growth*"
5. See e.g. an early advertisement cited by Cherry, "The Telephone System: The Creator of Mobility and Social Change", p. 121
6. Rogers, "*Diffusion of innovations*" pp. 15-16. In his book Rogers has given an extensive presentation of both the weaknesses and strengths of this classical model.
7. The notion is coined by Boettinger in his article "Our Sixth-and-a-Half Sense", p. 200-207
8. Latour, "*We have never been modern*", p. 109 (His own italic)
9. Haraway, "*Simians, Cyborgs, and Women: The Reinvention of Nature*" pp. 149-181
10. Sharp, "Steel Axes for Stone-Age Australians" and Peltó, "*The snowmobile revolution; Technology and social change in the Arctic*"
11. Basalla, "*The Evolution of Technology*"
12. Escobar, "Welcome to Cyberia", pp. 217
13. Erdal and Hallingby, "*Business as Usual During the Gulf War: The Norwegian Case*"
14. See the discussion in Miles et al., "*Information Horizons*", pp. 263-268 and Rondinelli, "*Development projects as policy experiments*"

15. Rondinelli, "Development projects as policy experiments", p. 99
16. In a review article of development projects in rural Norway, Hansen discuss this problem. He claims that in development projects the initiators often start projects without a strategy for how to continue the process after the first optimistic period. The result is therefore often disappointments and negative learning. See Hansen, "Regional ubalanse - teori, metode og ideologi", pp.3-32
17. Pinch, Asmore and Mulkay, "Technology, Testing, Text: Clinical Budgeting in the U.K. National Health Service", p. 285. Furthermore they claim in their article that "clinical budgeting" is a social technology with its origin in social sciences. However, I do not think it is necessary to claim that all kinds of "soft" technologies have their origin in the social sciences, but rather that the interaction between different sciences is more apparent when we study "soft" technologies. See p. 266.
18. Latour, "Science in Action", p. 108
19. Callon and Latour, "Les paradoxes de la modernité", pp. 13-25
20. See Rogers' discussion in "Diffusion of Innovations", pp. 95-103
21. In traditional innovation theory one assumes that the innovators are the most open minded users and the laggards the most conservative users. However, it is no laggard-problem when handicapped people are excluded from utilising new communication technology, but usually a problem with the user-interface, just to mention one example. I will therefore later on use the concept "relevant social group" instead of categorising different social groups by more or less intrinsic qualities. In his second rule of method Latour state in this respect that: "To determine the objectivity or subjectivity of a claim, the efficiency or perfection of a mechanism, we do not look for their *intrinsic* qualities but at all the transformations they undergo *later* in the hands of others". Latour, "Science in Action", p. 258
22. Different modifications of the translation model have been offered for more prescriptive purposes. See e.g. Callon et al., "The management and evaluation of technological programs and the dynamics of techno-economic networks: The case of the AFME" and Callon et al., "Mapping the dynamics of science and technology"
23. These concepts are introduced in a long range of articles and books. However, a more systematic account of the vocabulary is found in Akrich and Latour, "A Summary of a Convenient Vocabulary for the Semiotics of Human and Nonhuman Assemblies", pp. 259-64
24. See for example Brosveet, "Laboratorietanken: En blindgate i aktørnettverksteorien?"
25. Latour, "Science in action", appendix 1, "Rules of method", Rule 7, p. 258.
26. Woolgar, "Configuring the user: the case of usability trials", p. 60
27. The concept "technological frame" has been used by different authors. Bijker elaborates on the concept, stating that: "... a technological frame is heterogeneous, in the sense that it does not exclusively belong to the cognitive or the social domain". See Bijker, "Do Not Despair: There Is Life after Constructivism", p. 123. However, in my analysis I have used frame as solely a emic category, since descriptive units which are simultaneously emic and etic have no epistemological justification. See also footnote 33 and 34.

28. Bouissac, "Incidents, accidents, failures: The representation of negative experience in public entertainment", p. 414
29. Goffman, "Frame analysis"
30. Bateson, "A Theory of Play and Fantasy" and Goffman, "Frame Analysis"
31. Latour and Woolgar, "Laboratory Life"
32. In Harris, "The rise of Anthropological Theory". See especially the discussion on pp. 568-604
33. "Emic statements refer to logico-empirical systems whose phenomenal distinctions or "things" are built up out of contrasts and discriminations significant, meaningful, real, accurate, or in some other fashion regarded as appropriate by the actors themselves. An emic statement can be falsified if it can be shown that it contradicts the cognitive calculus by which relevant actors judge that entities are similar or different, real, meaningful, significant, or in some other sense "appropriate" or "acceptable". Harris, "The Rise of Anthropological Theory", p.571
34. Harris states that descriptive units which are simultaneously emic and etic have no epistemological justification. Harris, "The Rise of Anthropological Theory", p.577
35. This discussion is adapted from Entmann, "Framing: Toward Clarification of a Fractured Paradigm", pp. 51-58
36. Bateson, "A Theory of Play and Fantasy", p. 165
37. This is expressed in several of his scientific contributions. However, at this stage of my argument I will refer to an article in which Latour compares what Einstein says about the activity of building spaces and times with what sociologists of science can tell us. See Latour, "A Relativistic Account of Einstein's Relativity", pp.3-44
38. Goffman, "Frame Analysis", p. 346
39. When I speak of "case-studies" I have taken some experimental activities out of a larger social experiment, and I therefore do not aim at a complete description of all experimental activities. This has been done to facilitate a discussion of different types of experiments.
40. An early presentation of the "needs" of local industry is given in Hetland, "Næringsliv og offentlig forvaltning på Jevnaker - forslag til lokale forsøk med ny informasjonsteknologi"
41. Norges Offentlige Utredninger, "Telematikk"
42. FUNN = The Norwegian Research and Development Network
43. Blegen et al, "Oppbyggingen av IT-kompetansesentra i distrikts-Norge"
44. International Telecommunication Union, "The Missing Link"
45. Callon, "Society in the Making: The Study of Technology as a Tool for Sociological Analysis", pp. 83-103
46. Stehr, "Practical Knowledge", pp. 126-127
47. Sørensen and Levold, "Tacit Networks, Heterogeneous Engineers, and Embodied Technology", p.30
48. An overview of a variety of social experimentation with new telecommunication technology is given in Qvortrup et. al. (ed.), "Social experiments with information technology and the challenges of innovation"
49. See among others von Hippel, "The sources of innovation"

50. Discussed in Collett and Lossius, "Visjon, Forskning, Virkelighet - Televerkets Forskningsinstitutt 25 år", who describe the past period as "science founded planning" (p. 198), and the present change as a shift from plan to market (p. 195)
51. Shanklin, W. and Ryans, J.K. Jr. (1984) *Marketing High Technology*, Lexington Books, Lexington, M.A. Cited in Chidamber and Kon, "A research retrospective of innovation inception and success: the technology-push, demand-pull question", p. 111
52. In the US there already exists an organisation called Usability Professionals Association with 1000 members. A test centre for the improvement of user-machine interface was recently established in Denmark. Holmstad, "Computeren skal have et kønnere fjæs", Politikken (Danish daily newspaper), 10 March, 1994
53. A parallel claim is made by Barth, stating that "innovation for an entrepreneur must involve the initiation of transactions which make commensurable some forms of value which were previously not directly connected. Entrepreneurial activity thus tends to make a bridge between what before was separated". Barth, "Models of Social Organization", p. 18
54. Akrich, "User's representations: Practices, methods and sociology"
55. Latour and Woolgar, "Laboratory Life", (1986) p.279 (their own italic). See also Latour's discussion in "We have never been modern", pp.100-103
56. Conrath, Dunn and Higgins, "Evaluating telecommunications technology in medicine", p. 49
57. Mathisen, "Mellom forskning og praksis: Forsøk med telematikk", p. 68, translated from Norwegian by the author
58. Storgaard, "Dialogue Research - An Approach", p. 159. See also Cronberg, "Fremtidsforsøg" and Cronberg et al., "Danish Experiments - Social Construction of Technology". Dialogue research is closely related to action research. See among others Levin, "Action Research and Critical Systems Thinking: Two Icons Carved out of the Same Log?"
59. Cited in Collins, "Changing order", p. 30.
60. Hanson, "Testing Testing", p. 16
61. Melody, "Learning from the experience of others: Lessons from social experiments in information technology in North America", pp. 57-69
62. I got the idea for this arrangement in a discussion with Wiebe Bijker and he kindly lent me some pages of his forthcoming book "Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Socio-Technical Change"

Chapter 2

63. Huntford has made a comparative study of the two expeditions, see Huntford, "Scott and Amundsen"
64. Toffler, "The Third Wave", p. 372
65. Callon, "Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay", p. 196
66. Huntford, "Scott and Amundsen", pp. 556-557
67. Cronberg et. al., "Danish Experiments - Social Constructions of Technology"
68. Huntford, "Scott and Amundsen, p. 422

Chapter 3

69. Miles, Cawson and Haddon, "The Shape of Things to Consume", p. 72-73
70. Callon et al., "The management and evaluation of technological programs and the dynamics of techno-economic networks: The case of the AFME", p. 221
71. This does not mean that we don't find other strategies, according to Miles et al. "Japanese firms pursue a rather different approach to trialling and assessment of market potentials, at least within Japan - or so we have been told by European managers and Japan-watchers - releasing early versions of new products at high prices into domestic markets. A large group of enthusiasts in new technology - what in the UK are sometimes called 'zappers' - provides market feedback on the potential demand for such a product, and the characteristics that should be designed into it". Miles, Cawson and Haddon, "The Shape of Things to Consume", p. 73
72. Some of the innovations interpreted as failures, may therefore be "premature" and succeed at a later stage.
73. Elton and Carey, "Implementing Interactive Telecommunications Services", p. 41
74. Qvortrup et. al. (ed.), "Social experiments with information technology and the challenges of innovation" p. 2
75. Rondinelli, "Development projects as policy experiments"
76. Rogers, "Diffusion of innovations", p. 115
77. Pinch, "Testing - One, Two, Three...Testing!: Toward a Sociology of Testing", pp. 25-41
78. Lundvall, "Innovation as an interactive process: from user-producer interaction to the national system of innovation", pp. 349-69 and Lundvall (ed), "National Systems of Innovation"
79. Cited in Rothwell and Zegveld, "Reindustrialization and technology", p. 53
80. Katz, "The Management, Control, and Evaluation of a Telecommuting Project: A Case Study", p. 182
81. op. cit. p. 187
82. Casey-Stahmer cited in Elton and Carey, "Implementing Interactive Telecommunications Services", p. 49
83. Agrawal, "Anthropologists contribute to India's SITE experiment", pp. 32-36
84. Vilanilam, "Science Communication and Development", pp. 147
85. Bandler, "New Product Development in Telecommunications: Innovative Spirit and the Strategic Vision - The Essential Ingredients"
86. An inanimate object, that is believed to have magical powers
87. Hanson, "Testing Testing"
88. Arbo, "Prosjektmakeriets logikk: Fra modernisering til reføydalisering?", Jensen and Qvortrup, "Experiments out of the Future", pp. 235-58
89. Jensen and Qvortrup, "Experiments out of the Future", p. 251 (Their own italic)
90. Latour and Woolgar, "Laboratory Life" 1979 and 1986, Knorr-Cetina, "The Manufacture of Knowledge"
91. From Knorr-Cetina, "The Couch, the Cathedral, and the Laboratory", p. 117
92. Pinch, "Testing - One, Two, Three...Testing!: Toward a Sociology of Testing", pp. 25-41

93. Bijker et al., "*The Social Construction of Technological Systems*"
94. Callon, "Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay", pp. 196-233
95. Collins, "*Changing order*"
96. From Collins, "*Changing order*", p. 129
97. Polanyi, "*The Tacit Dimension*"
98. Hetland, "Å bli fisker - formell og uformell sosialisering i fisket", pp. 36-46 and "med 80 stamper line i halinga", pp. 75-89
99. Høst, "Teknologi og arbeid i norsk havfiske"
100. Knorr-Cetina, "*The Manufacture of Knowledge*", p. 129
101. Collins, "*Changing order*", p. 130
102. Latour, "*Science in Action*"
103. Collins, "*Changing order*", p. 129-130
104. Callon, "Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay". Collins and Yearley, "Epistemological Chicken". Latour and Woolgar, "*Laboratory Life*" 1979 and 1986. Latour, "*Science in Action*". Law, "Notes on the Theory of the Actor-Network: Ordering, Strategy, and Heterogeneity", pp. 379-93
105. Collins and Pinch, "*Frames of meaning*". Collins, "*Changing order*". Collins, "*Artificial Experts*"
106. Pickering (ed), "*Science as Practice and Culture*"
107. Gooding, "*Experiment and the making of meaning*", p. xi
108. Barnes, "Class and Committees in a Norwegian Island Parish", p. 43
109. Collins, "*Changing order*", p. 131
110. Hesse, "*The Structure of Scientific Inference*"
111. Collins, "*Changing order*", p. 132 (His own italic)
112. Collins and Yearley, "Journey Into Space", p. 373
113. Granovetter, "The Strength of the Weak Ties", pp. 1360-1380
114. For a discussion see Granovetter, "The Strength of the Weak Ties: A Network Theory Revisited" and Friedkin, "A test of structural features of Granovetter's strength of weak ties theory", pp.411-422
115. Callon, "Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay"
116. Law, "The Anatomy of a Socio-Technical Struggle: The Design of the TSR 2"
117. Feldman, "*Concord and Dissent*"
118. MacKenzie, "Missile Accuracy: A Case Study in the Social Processes of Technological Change", pp. 195-222
119. Latour, "*Aramis, ou l'amour des techniques*"
120. Brosveet, "Laboratorietanken: En blindgate i aktørnettverksteorien?", p. 10
121. Case, "An example of the social construction of information technologies: Videotex in the United States and Europe", pp. 139-49. Robson, "On the arenas of accounting change: The process of translation", pp. 547-70. Bloomfield, "The Role of Information Systems in

- the UK National Health Service: Action at a Distance and the Fetish of Calculation", pp. 701-34
122. Cambrosio and Limoges, "Controversies as Governing Processes in Technology Assessment", pp. 377-96. Cambrosio, Limoges and Hoffman, "Expertise as a Network: A case Study of the Controversies over the Environmental Release of Genetically Engineered Organism, pp. 341-61
123. Benghozi, "Managing Innovation: From *ad hoc* to Routine in French Telecom", pp. 531-54. Benguigui, "Polywater, sociology of an artifact", pp. 643-67
124. See e.g. Perez and Soete, "Catching up in technology: entry barriers and windows of opportunity", pp.460-63. In Williams and Gibson (ed.), "*Technology Transfer - A Communication Perspective*", several of the authors discuss more communication-based models with stronger emphasis on user involvement and network analysis. However, it is difficult to find theoretical contributions that really improve the understanding of user involvement in diffusion.
125. Mackay and Gillespie, "Extending the Social Shaping of Technology Approach: Ideology and Appropriation", p. 691
126. Alkrich, "The De-Scriptio of Technical Objects", p. 208
127. See footnote 21
128. Benguigui, "Polywater, sociology of an artifact", p. 663 (my own italic)
129. Latour, "*The Pasteurization of France*"
130. Hartley, "Social experiments and the role of end-users", pp. 261-269
131. Beauchamp, "Ethical theory and the problem of closure", pp. 27-48
132. McMullin, "Scientific controversy and its termination", pp. 49-92

Chapter 4

133. Jussawalla, "Is the communications link still missing?", pp. 485-503
134. Hughes, "The Evolution of Large Technological Systems", p. 76
135. Umble, "The Amish and the telephone", pp. 183-194
136. Word-by-word translation with a memorised dictionary may contain ambiguities, and may even not make good sense, but this is the price of a working, mechanical, computerizable task. See Collins' discussion in his book "*Artificial Experts - Social Knowledge and Intelligent Machines*"
137. Godø, "*Om datakommunikasjon og samfunnsending*"
138. Chidamber and Kon, "A research retrospective of innovation inception and success: the technology-push, demand-pull question", p.101. See also the recent discussion presented in the special issue of Social Studies of Science on "Failed Innovations", 1992 no. 2.
139. Antonelli, "The diffusion of information technology and the demand for telecommunication services", pp. 261-262
140. Jeppesen and Poulsen, "The text communications battlefield: installed base, externalities and the fall of the teletex system", pp. 66-77
141. Teletex was designed as a modern, computerised version of the classic switched telegraph system. The teletex terminal also had some similarities with the first terminals for word processing.

142. The "post-industrial" mode of production also called the "information economy" is described by Bell, *"The coming of post-industrial society: A venture in social forecasting"* and Porat, *"The Information Economy: Definition and Measurement"*, just to mention two classical contributions. The "information economy" is usually defined indirectly by a typology of information occupations within the total economically active population. However our conception of the "information economy" often includes several of the definitions of information in use. Braman tries to systematise the field and suggests four broad groups of definitions of information: 1) Information as a resource. Popular definition in mass communication theory, diffusion studies, the New World Information Order debate and more general policy discussions. 2) Information as a commodity. These definitions have value in juridical fields, trade areas, etc. 3) Information as perception of pattern. These definitions broaden the concept of information by adding context. They are however difficult to use in a policy-making context. 4) Information as a constitutive force in society. Definitions in this category grant information an active role in shaping context. These definitions make policy decisions about information a decision about how society is to be structured. See Braman, "Defining Information: An approach for policymakers", pp. 233-242
143. Willoughby, *"Technology Choice - A Critique of the Appropriate Technology Movement"*
144. Qvortrup, *"Det levende eller det døde samfund"*, p. 15
145. OECD, *"Trends of Change in Telecommunication Policy"*, 1987
146. Hudson, *"When Telephones Reach the Villages"* and Hudson, *"A Bibliography of Telecommunications and Socio-Economic Development"*
147. For a lengthy discussion on integration question see Samarajiva and Shields, "Integration, Telecommunication and Development", pp. 84-105
148. Toffler, "Untitled", 117-118
149. Toffler, *"The Third Wave"*, p. 372
150. I will use the notion "telecommunication" when speaking of plain telecommunications and the notion "telematics" when speaking of the process towards integration between telecommunication and information technology. Two French scientists, Simon Nora and Alain Minc, were the first to use the expression telematique. In a report to the President of the French Republic in 1977 they used this expression to describe the on-going merger of telecommunication and informatics.
151. Naisbitt, *"Megatrends"*. Norges Offentlige Utredninger, *"Telematikk"*. International Telecommunication Union, *"The Missing Link"*. Toffler, *"The Third Wave"*
152. Norges Offentlige Utredninger, *"Telematikk"*, p. 24
153. International Telecommunication Union, *"The Missing Link"*, p. 3
154. The issues are most explicitly treated in sections 5.5.5 and 5.6 in Norges Offentlige Utredninger, *"Telematikk"*
155. Bloor, *"Knowledge and Social Imagery"*
156. Callon, "Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay", pp. 196-233

157. Blegen et al, "Oppbyggingen av IT-kompetansesentra i distrikts-Norge". All citations in this sequence are my own translations of texts from pages 3-5 in the Blegen report.
158. This was made relevant by the fact that Norsk Data wanted to use 135 million NOK from tax credit funds established for investments in the districts in order to buy their own machines and then lease these back to the centres at rates very favourable to Norsk Data. This arrangement was very profitable to Norsk Data. However, the tax credit already given was dependent on where the investments were going to be made. Two years later, Norsk Data went bankrupt.
159. International Telecommunication Union, "The Missing Link", p. 3
160. International Telecommunication Union, "The Missing Link", p. 7
161. International Telecommunication Union, "Arusha Declaration", p. 6
162. Discussed in Collett and Lossius, "Visjon, Forskning, Virkelighet - Televerkets Forskningsinstitutt 25 år", who among others cite politicians from the Labour party, pp. 20

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163. Collett and Lossius, "Visjon, Forskning, Virkelighet - Televerkets Forskningsinstitutt 25 år", p. 144
164. This did not happen, but this is how the development was interpreted at the time.
165. Mathisen, "Erfaringer fra den telematiske sandkasse: Et tilbakeblikk på første fase av forsøk med ny teleteknikk og nye tjenester på Jevnaker", p. 8
166. Both citations from Dragland, Mathisen and Sinkerdud, "The Telematic Sandbox: A Field Trial with Cable Television at Jevnaker", p. 10
167. Mathisen, "Erfaringer fra den telematiske sandkasse: Et tilbakeblikk på første fase av forsøk med ny teleteknikk og nye tjenester på Jevnaker", p. 12
168. Mathisen, "Erfaringer fra den telematiske sandkasse: Et tilbakeblikk på første fase av forsøk med ny teleteknikk og nye tjenester på Jevnaker", p. 49
169. Hetland, "Næringsliv og offentlig forvaltning på Jevnaker - forslag til lokale forsøk med ny informasjonsteknologi". In the survey it was stated that participation would not lead to any important expenditure on investments. They had, however, to cover their own expenses for the personnel involved.
170. For a description of the translation process see Latour, "Science in action", especially pp. 108-144
171. I have borrowed the concept "chaos pilot" from a pioneering educational project in Aarhus, Denmark, in which they have tried to educate young people to master the chaos of the new society by a multiplicity of skills, putting emphasis both on creativity and more practical skills.
172. Mathisen, "Erfaringer fra den telematiske sandkasse: Et tilbakeblikk på første fase av forsøk med ny teleteknikk og nye tjenester på Jevnaker", p. 17
173. Odden, "Næringslivet og telematikksenteret på Jevnaker", p. 22-23
174. Mathisen, "Erfaringer fra den telematiske sandkasse: Et tilbakeblikk på første fase av forsøk med ny teleteknikk og nye tjenester på Jevnaker", p. 84

175. However, the Jevnaker project gave important general experience, which later led to such new products as the video phone or important experience with new technology like fibre optic cables. One can therefore argue that even failed projects can be justified both as a learning process and in economic terms. For a more detailed discussion of the "scrap value" of telecommunication R&D see Godø, "*R&D and technological innovations in telecommunications: Innovation regimes*"
 176. Odden, "*Næringslivet og telematikkssenteret på Jevnaker*", p. 128
 177. Nymo, "Fra sandkasse til distrikt"
 178. von Hippel, "*The sources of innovation*", p. 102
 179. Hetland, Knutzen, Meissner and Olsen, "*Nært, men likevel fjernt*", pp. 203-204
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180. For a detailed account of this test, see Knutzen and Hetland, "*Fjernarbeid i distriktene - telematikk mot marked*". A shorter presentation is to be found in Hetland, Knutzen, Meissner and Olsen, "*Nært, men likevel fjernt*"
 181. A reason for this was that the authorities were unsure about how the use of new telecommunication services would influence, among other things, travelling. One anticipated possibility was that the need to travel would only increase with advanced use of telecommunications.
 182. Several notions have been used like Community Tele-Service Centres, Telehouses, Telecottages or Telematic Centres. However, in this chapter I will use "telecottage" as the common denominator since this concept reflects the perceived possibilities at that time even if some of the initiators gave their projects other names, depending on their perception of the actual market.
 183. In the previous chapter I have mainly focused on the first phase of the Jevnaker project, the phase leading to the "social invention". The second phase is only briefly mentioned and the experience from this second phase will be discussed together with the seven other pilot experiments in the second part of this chapter.
 184. Priorities were expressed by decisions in the steering committee. However, the priorities were not necessarily followed up by money or, if not taken into consideration, sanctions.
 185. In order to prepare the conditions for diffusing ideas and competence between the Nordic projects a collaboration between the Nordic countries was established. This Nordic initiative lead to the establishment of the Nordic Association for Community Tele-Service Centres (FILIN). FILIN was established as a Nordic association with the purpose of supporting the present and the future centres. This work went on from 1986 to 1990, and in many ways, led to new projects or institutions being all the time actively brought into testing new regionally based models for diffusion of technology. In spite of some problems, FILIN played an important role in several local projects. At its zenith in 1989, the organisation had contact with 70-80 local projects in the Nordic countries. A large portion of the activities has been documented in the journal FILINFO.
 186. von Hippel, "*The sources of innovation*"
 187. The Jevnaker project had a special advantage in this respect, since both a local TV-station and a local radio-station were included in the project.

188. The profile of this mountain is known to most Norwegians and is called Prekestolen or the Pulpit, consisting of a majestic mountain ledge approximately 600 meters above Lysefjorden.
 189. Huws, Korte and Robinson, "*Telework - Towards the Elusive Office*", p.1
 190. Jørgensen, "*Nærarbeide og lokale data/telesentre*", p. 19
 191. For a more detailed presentation see Knutzen and Hetland, "*Fjernarbeid i distriktene - telematikk mot marked*". The survey was conducted with a questionnaire and included 120 firms in Oslo and Stavanger. Later 12 of these firms participated in more open-ended interviews, with the purpose of understanding decision-making processes.
 192. Policy measures like the possibility of "forcing" large companies to buy some of their required services from regionally based firms and/or that they relocate some of their own activities were discussed. Legislation to enforce this was on the statute book. However, the climate in both the administration and among the majority of politicians did not favour any real enforcement of these legal channels.
 193. I have adapted the analytical scheme presented by Daft, "*Organization Theory and Design*", p. 290
 194. Williamson, "*The economic institutions of capitalism*"
 195. Arrow, "*Information and economic behaviour*"
 196. Williamson, "Markets and hierarchies: Some elementary considerations", pp. 316-25
 197. Nybakk, "*Fjernarbeid - en IT-basert luksustilpasning for velutdannede menn i storbyområder?*"
 198. Privat tjenesteyting i distriktene (PTD) are described in several publications published by the Ministry for Local Government
 199. St. meld. nr. 29 (1988-89), "*Politikk for regional utvikling*"
 200. Norges Offentlige Utredninger, "*Dataregister til distriktene*"
 201. Goffman, "*Frame Analysis*". I will not elaborate on the concept of keying, since the semiotic vocabulary already suggested in my analysis may be perceived as a more elaborated extension of the "key" concept.
 202. Asker and Ulstein, "*EDB-bransjen bare i sentrum?*"
 203. See Hetland, Meissner and Odden, "*Håndbok for lokal telematikkutvikling*"
 204. The article was printed in Computer World Norge 1987 no.37
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205. Pinch, Asmore and Mulkay, "Technology, Testing, Text: Clinical Budgeting in the U.K. National Health Service" and Pinch, "Testing - One, Two, Three...Testing!: Toward a Sociology of Testing", pp. 25-41
 206. Computer World Norge, 1993 no.15
 207. How much money was actually used is disputable, Berg, Gilleberg, Aalbu, "*DU - ny aktør i kunnskapsmarkedet*", p.62 claim that at least 300 million NOK were used.
 208. The centres should be offered ND 5900/4 with the capacity of 25 MIPS distributed on four processors, 20 MBytes internal memory and 1 GByte external memory. The machines should be linked together in a network that among other things should give Norway an important impetus in the implementation and use of ISDN.
 209. A regional research institute

210. In an evaluation of the National IT-plan, the evaluators claim that: "Inside Norsk Data the plan (FUNN) was only discussed in the financial department (not at the top managerial level), which indicates that the initiative was mostly perceived as a technical measure to release tax reductions.". Harlem et. al., "*Evaluering av nasjonal handlingsplan for informasjonsteknologi 1987-1990*", p. 151
211. Mo had earlier been the national centre for steel production, owned by the Norwegian state, and as a consequence of closures and rationalisation many people lost their jobs. As Mo had no alternative jobs to offer the Government has later used vast resources to establish new activities in Mo. That Mo was assigned the co-ordination function was therefore solely a political decision not related to any special local expertise.
212. Jensen, "*FUNN - Status og utfordringer*", p.1. Internal memo, 1989. The total project period was to be four years. Whether this also applied to early "failures" is however not discussed in any written text to my knowledge.
213. A Norwegian consortium basically supplying the municipalities and public authorities with computer services, and mostly owned by the municipalities and counties.
214. FUNN-senteret for Hedmark and Oppland, "Oppsummering av konferansen om FUNN-satsingen".
215. Sintran was the system used only by Norsk Data, and the lack of compatibility with different other systems e.g. MS-DOS, confined the users to a limited number of software packages. One important side-effect of this project, seen from Norsk Data, was perhaps to increase the number of available software packages. However, several critical commentators felt that Norsk Data was too late in their change to other systems than Sintran.
216. Rogers and Kincaid, "*Communication Networks*". DeBresson and Walker, "Network of Innovators"
217. Feifer, "*Going places - the ways of the tourist from imperial Rome to the present day*" p. 256
218. FUNN-senteret for Hedmark and Oppland, "Oppsummering av konferansen om FUNN-satsingen".

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219. Number of calls made to different destinations from the three different places studied (underlined). The numbers in brackets indicate local telephone calls. As Kraké does not have telecommunication system it is not marked on the map. However, the village is just south-east of Porto-Novu. The figures are from a survey conducted from March to June 1992.
220. All the figures of use are from a survey of 265 telephone callers using a public telephone, 56 telephone callers using a private telephone, and among 40 persons living in Kraké with no telephone system in operation.
221. Samarajiva and Shields, "Integration, Telecommunication, and Development: Power in the Paradigms", p. 96
222. Lorentzen, "*Technological Capacity*"
223. Mowlana, "The Myths and Realities of the "Information Age": A Conceptual Framework for Theory and Policy"
224. Pinch, "Testing - One, Two, Three...Testing!: Toward a Sociology of Testing", p. 36

225. Akrich and Latour, "A Summary of a Convenient Vocabulary for the Semiotics of Human and Nonhuman Assemblies", p. 261
226. 50 CFA=1 Ffr. at the time of the interviews, in January 1994 the currency was devalued so that 100 CFA=1 Ffr.
227. Morris and Stavrou, "Rural Communications"
228. Dutton and Meadow, "A tolerance for surveillance"
229. Goffman, "The presentation of self in everyday life"
230. Fischer discuss the problem of "eavesdropping" in the early period of the telephone in America. The problem of eavesdropping caused some uproar and contributed to the most dramatic case of telephone controversy, the decision of the Pennsylvania Amish to ban the device. See Fischer, "America Calling: A Social History of the Telephone to 1940"
231. Meyrowitz, "Redefining the situation: Extending dramaturgy into a theory of social change and media effects", pp. 65-97
232. Dondoux, "Communication: everyone's right", pp. 670-672
233. The numbers indicate the percentage of the relevant social group expressing a problem or need.
234. Modified after Mowlana, "The Myths and Realities of the "Information Age": A Conceptual Framework for Theory and Policy", p. 436
235. Katz, "The Information Society. An International Perspective"
236. Resolution AM-RDC/92 No.2, p. 73-74
237. Qvortrup, "Community TeleService Centres: A means to social, cultural and economic development of rural communities and low-income urban settlements"

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238. Lodge, "Small World"
239. Elton, "Visual Communication Systems: Trials and Experiences", p. 2
240. See Rogers, "Diffusion of Innovations", pp. 16-17
241. Of course the technology also had to work. However, the viability of technology in the more narrow sense was seldom the critical issue in the hybrid communities. Furthermore, the qualities of technology are a consequence, not a cause, of collective action.
242. Callon, "Techno-economic networks and irreversibility", p. 147
243. Cited and discussed in Goldhaber, "Organizational Communication", pp. 250-251
244. Dervin, "Users as research inventions: how research categories perpetuate inequities", pp 216-232
245. Latour, "The powers of association", p. 267
246. I have borrowed these two concepts from Manning and Hawkins, "Legal desicions: a frame analytical perspective", pp. 203-233
247. Woolgar, "Configuring The User: the case of usability trials", p. 61
248. Goffman, "Frame Analysis", p. 73
249. Bateson, "Towards a Theory of Scizophrenia"
250. Arbo, "Prosjektmakeriets logikk: Fra modernisering til reføydalisering?"
251. Weick, "Substitutes for Strategy", p. 227
252. See Hansen, "Regional ubalanse - teori, metode og ideologi", pp.3-32
253. Mathisen, "Field trials: What's the use?", p. 151

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Appendix 1 Fieldwork and Documentation

The explorative Experiment

The fieldwork for the Jevnaker project took place from May 1984 to June 1985 and included a "need assessment" among 98 firms and a survey of the actual communication activities in 25 of these firms before the experiment. This part of the fieldwork was undertaken on behalf of Telenor Research. Furthermore, a special study of the agricultural sector was conducted on behalf of a group consisting of different agricultural organisations and The Agricultural Research Council of Norway. Apart from my own research I have relied on other research projects and reports from Telenor Research and the Eastern Norway Research Institute.

The Pilot Experiment

The present research project, "Teledistributed Services and Strategic Networks - Conditions for Export of Services from Rural Norway", has been supported by the Norwegian Research Council. The work was conducted together with my colleague, Arild Jansen, at Finnmark College. The main activity in this project was a restudy of the research and development project performed in the following communities: Vardø, Dyrøy, Hamarøy, Smøla, Forsand, Gjesdal, Dovre and Jevnaker. The first period of this research was reported in Hetland, Knutzen, Meissner and Olsen, "Nært, men likevel fjernt - Telematikk og lokal utvikling" (Close, but Still Remote - Telematics and Local Development). The original research projects took place from June 1985 to early 1989. The co-operation of Odd Einar Falnes Olsen, Petter Knutzen and Rudolf Meissner is gratefully acknowledged.

The Demonstration Experiment

The empirical material for this chapter was collected by participant observation (e.g. participation in meetings as representative for one of the potential host organisations, the Eastern Norway Research Institute), through informal and

formal interviews, especially among the FUNN-staff at Gjøvik and Alta, archive studies and the reading of public documents. The final research has been conducted as part of the research project, "Teledistributed Services and Strategic Networks - Conditions for Export of Services from Rural Norway", that has been supported by the Norwegian Research Council from 1991 to 1994.

The Replication Experiment

This is earlier presented in Hetland, "Integration, Telecommunication and Development: Rural Tele Service Systems in Bénin", an extended version of the empirical part is also presented in this report. The research project "Telecommunications in Developing Countries - Organisational Models for the Development of Telecommunications in Rural Areas", was made possible by support from The Norwegian Research Council for Applied Social Science and by co-operation and support from Office des Postes et Telecommunication (OPT) of Bénin and The International Association of Community Tele Service Centres in France. During the project I visited Bénin four times in the period from 1989 to 1992 and many people in Bénin were very supportive. I am especially grateful to Gounde Désiré Adadja, Flavien Bachabi, Honoré Vignon, Nassirou Machioudi, Joachim de Souza at OPT and Lars Engvall and Pierre Luhan at The International Association of Community Tele Service Centres. I also want to express my gratitude to Taofiqui Bouraima, former minister of communication in Bénin, who unfortunately died in June 1990. His help and support have been of great importance. Pierre Luhan, was my companion at the first visit to Bénin and later, his guidance was both stimulating and inspiring. The news of his sudden death in August 1993 was therefore received with great sorrow.

Appendix 2 Rural Telecommunication Policy in Norway

As a small country of only 4.2 million people located in the northernmost part of Europe, Norway has 13 persons per km² and is one of the most sparsely populated countries in Europe. For many rural communities in Norway, distance has therefore been considered as one of the most important barriers to economic development. It is true that these communities often are located in the vicinity of raw materials, be it soil, forest or fish, but they are far from the markets, the political decision makers and, particularly, the important know-how centres. These and other circumstances have caused many rural communities to fall behind in general economic development.

The increase in the number of jobs outside the public sector has been small, and the jobs established in local industry have, in general, offered few challenges for educated young people. In addition, opportunities within the service, education and culture sectors have been very few.

After an intensification of construction and improvements in the telecommunication network, the queues for telephones disappeared in the early 1980s and today almost 100% of all households have access to a telephone. With an already well functioning basic tele-communication network, many rural communities have viewed the emergence of new telecommunications technology or telematics with high expectations. Telecommunications provide the possibility of stepping over the distance barrier.

The ability to convert time consuming forms of communication to time-saving-ones is therefore looked upon as one of the most promising possibilities of the new telecommunication technology in a regional context. This later point is especially important because it often shows that distance is first of all the mental expression of a time barrier, and that high expenditures are principally connected to time consumption and not to the cost of transportation.

In the following overview of Norwegian policy initiatives I have organised the activities in four categories. The first main category is the infrastructure, and closely connected to the infrastructure are the policies for new services,

especially Value Added Services (VAS). The next two categories are linked to direct support for development of local industry. I will both look at supply-side and demand-side activities. In addition to direct support the Norwegian Government also put emphasis on a general decentralisation of public activities. An important field for regional policy has therefore been to locate new government funded activities in the regions.

In all the four categories I will concentrate on what I find particularly important for regional and rural development.

Infrastructure

Since 1982, telecommunication policy in Norway has been subject to several important changes with a focus on liberalisation and deregulation. Four commissions have been set up by the Ministry of Communications:

- Tele Commission 1980-83
- Organisation Commission 1983-84
- Interface Commission 1985-86
- Value-Added Services Commission 1986-1988

The main result of these four commissions has been to give Telenor the sole right to two-way transmission of voice, text, data and picture between subscribers in the public network implemented and operated by Telenor. One of the foremost tasks is the introduction of digital exchanges in the network. Later, Telenor has participated in the competitive market through a subsidiary limited company (TBK). Concerning the Value-Added Services (VAS) parliament decided that Telenor and private suppliers can freely compete on equal terms and that opening of the VAS market will require a transition to cost-related tariffs.

Telenor also has to fulfil some social and regional obligations, among which we may mention:

- long-distance telephone tariffs shall be the same for all distances above 50 km.
- the telephone apparatus shall be supplied at a single price for all parts of the country (now supplied by competing companies),
- telephone installation and subscription shall cost the same throughout Norway.

These and other obligations require "cross-subsidising" which, to a certain degree, is in opposition to "competition on equal terms". The politicians are

unlikely to remove these obligations, but in the future the costs can of course be covered by others than Telenor.

So far the main goals for Telenor for the period 1990-94 include:

Modern and effective tele services

- Full coverage of the demand for tele services
- Cheaper tele services and cost-related prices
- High quality on delivery and reliability
- Fast digitalisation
- Introduction of an integrated services network (ISDN) for commercial service from the early part of the 1990s.

Telecommunication policy has also been part of regional policy and in the document entitled "Policy for regional development" of 1988/89 the Norwegian Government stressed the following tasks:

- to contribute to creating the conditions for geographically dispersed small businesses and to provide more diverse employment opportunities and a more balanced economic activity in rural areas by:
- enhancing the performance of existing commercial activities in rural areas, including tourism,
- increasing the independence and competitiveness of small and medium-sized enterprises and local service providers by giving them better access to business services and larger markets,
- stimulating and supporting the growth of new businesses, industries and commercial activities in rural areas,
- to organise, in co-operation with local industry, extension services and stimulate research and development work,
- stimulating co-operation between local industry and the educational system to enhance local competence,
- contributing to the business activities in the field of private services giving priority to information technology and new services (especially Value-Added Services) and knowledge-based services (especially R&D and different kind of consultancy firms)
- to reverse the out-migration of young and skilled people into urban centres, and to encourage in-migration of the economically active population;
- to establish a basis for provision of improved commercial, social, cultural, educational and health services to dispersed and isolated populations;
- to raise the level of awareness of the potential of information and communication technologies and contribute to raise the level of information and communications technology skills in rural areas.

Telecommunications and regional development in Norway is first and foremost about *new services* and *infrastructure*. The introduction of ISDN opens up for a whole range of new services. So far there are no good definitions of VAS

and I will therefore use the expression teledistributed services. Studies of teledistributed services lead us to distinguish between:

- a) teleassisted services, and
- b) telebased services.

Teleassisted services refer to services in which telecommunications are necessary in order to perform the service over large distances. The *service itself* may in some cases be performed without the benefit of telecommunications, but then at another geographic locality or at essentially higher costs. Teleassisted services are not standardised, and telecommunications are only a tool in the production of services. In relation to the customers, we may here talk about a high degree of customer adjustment. So far, teleassisted services have been the easiest adaptation in relation to the local basis of experience and competence. In several Government funded programs, such as "Private services in the districts", the focus has mostly been on teleassisted services.

In telebased services, various *telecommunication solutions are an integral part of the service concept* and necessary both for the service itself and for its distribution. Telebased services are characterised by a high degree of standardisation. In relation to customers, a great deal of importance is given to self-service. Databases, electronic mail, etc. are growing in importance. However several of these services still need a better *institutional infrastructure* if they are going to "take off".

Supply-Side Actions

Supply-side policies for information technologies (IT) are divided between relatively traditional forms of *state industrial policy* and *innovation policy*. Industrial policy has tended to give way to innovation policy. In this respect, one of the more important instruments in Norway has been the organisation of a platform for research in the regions. The Government has put emphasis on the potential for rural areas to compete on the markets for new services and especially knowledge-based services. Several steps have been taken to reach such goals:

- 1) From 1970 to 1985 a new university and 14 new regionally based colleges were introduced in the system of higher education.
- 2) Between 1970 to 1989 19 new Regional Research & Technology Centres supported by the Ministry of Local Government have been established. In addition several local and regional technology centres supported by local industry, municipalities, counties and others have been established.

Demand-Side Actions

One general policy on the demand-side is the different monetary incentives to encourage technology introduction, several of them being administered through the Regional Development Fund or specially designed programs. Furthermore, different information campaigns have been launched and incentives introduced to get an assessment of the firms' needs. The basic idea behind these programs is that the firms do not have the necessary knowledge to assess their own needs. By making the need more apparent, such firms it is assumed, will also demand new technology. So far it may seem probable that many of the firms would have taken the technology into use anyhow, but the assessments may prove useful for the small and medium sized firms to organise the introduction process in a more economic way.

Decentralisation of Public Activities

Norway has long traditions when it comes to decentralisation of public activities. Since it so far has been difficult to decentralise already existing institutions, policy makers have concentrated their efforts on the localisation of new public institutions. The establishment of different kinds of public databases has therefore been influenced by decentralisation. Several public databases are already located in the regions and a Commission established by the Ministry of Industry and the Ministry of Local Government concluded that the location of public databases are to be important instruments of regional policy. They emphasize that it is crucial to take into account the importance of location, the competence required for the different jobs and of course how to get the best effects out of such a decentralisation.

Appendix 3 Rural telecommunication policy in Bénin

Bénin is situated in the Western part of the African Continent. Bordered in the East by Nigeria, in the West by Togo, in the North by Burkina-Faso and Niger, on the south is the Gulf of Guinea with a 125 km coastline. By 1992 the Bénin population was estimated to be 4,8 million with an average annual growth rate of 2,8%. This population is unequally distributed; clustered mostly in the southern part; in particular in the Atlantic, Ouémé and Mono provinces where population density varies between 133 and 193 inhabitants/km². The demographic density puts a strong pressure on the cultivable soils of the southern part of the country. About 74% of the active population are employed in the rural sector. This percentage is relatively smaller in the Ouémé and Atlantic provinces (respectively 55 and 51%).

If we look at the overall situation concerning annual population growth, the percentage of the population working in agriculture and last, but not least the national telephone-traffic we find the following picture:

Provinces	Population ¹	Annual growth in %	Density pr. km2	% of the population	% of the population working in agric.	% of the telephone-traffic in 1985 ²	% of the telephone-traffic in 1990
Ouémé	626.870	1,6	134	19	55	15,1	15,5
Atlantique	686.260	4,2	213	21	51	69,9	60,4
Mono	477.380	2,6	127	14	85	1,6	3,6
Zou	570.430	1,5	31	17	85	7,2	8,3
Borgou	490.670	2,5	10	15	80,5	4	7,7
Atacora	479.600	2,2	16	14	88,5	2,2	4,5
Bénin	3.331.210	2,4	30	100	73,5	100	100

Table of the Provinces

In the two northernmost provinces of Borgou and Atacora, where three of the pilot projects are located, the annual population growth is about average,

the density of the population is the smallest and the percentage of the population working in agriculture is very high. It is highest in Atacora with 88,5% of the population in agriculture. The percentage of telephone traffic here is small, but rising.

The implications of the geographically uneven distribution of telecommunications are that only 30% of the population lives in regions with an existing telecommunication system.

Percentage of the population in regions with a telecommunication system³

Provinces	Regions with telecom. system	Regions with very few telecom. connections	Total %
Oueme	32,2	67,8	100
Atlantique	54,9	45,1	100
Mono	13,6	86,4	100
Zou	24,9	75,1	100
Borgou	26,4	73,6	100
Atacora	11,6	88,4	100
Bénin	29,2	70,8	100

Atacora has only a small part of the national telephone-traffic, but also the smallest part of the local population in reach of a telephone. A tentative projection of the population figures will result in a telephone density of about one telephone per 100 inhabitants in the regions with an existing telecommunication infrastructure, while the rest of the population have almost no means of tele services. The present figures indicate about 14.000 direct mainline telephones in Bénin, which is equivalent to 0,36 mainline for every 100 inhabitants. 15.911 are on the waiting lists. So merely to meet expressed demand, Bénin must double the number of mainline telephones. However, expressed demand does not reflect the real demand for two reasons; a) many potential owners of private telephones do not bother to register as the prospect of getting a telephone installed is rather small and b) the expressed demand is only for private telephones and not for "shared" public telephones.

Following the drawing up of a telecommunication master plan, completed in January 1986, and establishing the telecommunication network development forecasts for the next 20 years, a short-term program covering the 1988-1993 period was established for funding by various financial backers.

This program comprises:

- the digitalisation of the Cotonou and Porto-Novo telephone exchanges
- the modernisation and expansion of the Cotonou and Porto-Novo local networks
- the purchase and installation of transmission equipment
- the introduction of rural telecommunications with the realisation of a pilot-project of rural telephony in the Atacora province.

In the development and implementation program for rural telephony, three steps have been specified:

- 1° Connecting localities important from an administrative point of view
- 2° Expanding these networks towards the district capitals (chefs-lieux de districts)
- 3° Progressively connecting the district and rural areas subscribers

All this with the aim of being able to put a telephone set at the population's disposal within a maximum range of 10 km.

According to the National Development Plan there will be 53.033 direct mainline telephones in Bénin in year 2000 (Plan Directeur National des Telecommunications). Hence if it is to be possible to meet the rising demand for tele services in rural areas and ensure that the implementation of new tele services improves the possibilities for rural development, it is important to look into a wide range of possible solutions.

Notes to Appendix 3

1. In this table I have used the 1979 figures from the Institute National de Statistique et de l'Analyse Economique (INSAE)
2. The telephone traffic estimates are from the Plan Directeur National des Telecommunications of 1985. The estimates build on a small sample and must therefore here be used as a more general indicator to illustrate the differences between the regions
3. The relative shares are calculated on the basis of the population census from 1979

Exploring Hybrid Communities: Telecommunications On Trial

Per Hetland

The act of telephoning has become such an integrated part of our daily lives that we have stopped thinking about it. New telecommunication services have changed our original inventory, implying that we can now delegate the ability to overcome both time and distance to telecommunicational artifacts. During the 1970s and 1980s, politicians expected that telecommunications would perform miracles in linking urban and rural areas. At the extreme, they conceived of the world as a "global village" in which the best from the rural and urban areas could be blended. To explore and develop the new possibilities, many "social experiments" with new telecommunication services were launched. These "social experiments" resemble hybrid communities with the intention of exploring how this technology may give the acting human a growing number of artifacts to recompose social links and extend their scale. The thesis discusses the different roles that hybrid communities are given when it comes to innovation and the diffusion of innovation.

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