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Formative Infrastructure for IT-Adoption Understanding the Dynamics of IT-Use in SME's

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Abstract

IT has considerable importance for productivity increase and growth. IT use requires a lot of resources to create value. Few, if any, studies, take the perspective of SMEs' needs for infrastructure concerning use of IT. As resources are more limited in smaller enterprises, and the contexts and conditions for IT use in SMEs are not well known. Formative infrastructure is a way of understanding cognitive and technical arrangements needed for IT adoption and use, depending on IT resources crossing organizational boundaries. The purpose is to study conditions for IT-use in SMEs for a better understanding of how a formative infrastructure contributes to enterprises. The methodological point of departure and approach in this study is qualitative and explorative. More than 60 interviews are performed within a geographical region. Questions concern needs for infrastructure among SMEs, actors roles, and concepts constituting a formative infrastructure for IT adoption and use. Data was analyzed for similarities and patterns into themes and topics. A theoretical framework for formative infrastructure is presented as a multi theory lens for developing the concept of formative infrastructure. A formative IT infrastructure is constituted by the identified needs among SMEs, and it contains three parts; (1) sensemaking, (2) senegiving, and (3) service infrastructures. Formative IT infrastructure in SMEs is not a well known concept, concerning IT use in SME's. The need of for formative infrastructure in sensemaking IT adoption and use in SME's rely on external partners and other actors for sensemaking and sensegiving processes. Further research is needed for better understanding of actors and roles as well as arenas for sensemaking IT in SMEs. The emphasis on infrastructure for IT adoption processes will help SME's to more relevant investments.

FORMATIVE INFRASTRUCTURE FOR IT-ADOPTION

UNDERSTANDING THE DYNAMICS OF IT-USE IN SME'S

Abstract

Purpose
IT has considerable importance for productivity increase and growth. IT use requires a lot of resources to create value. Few – if any – studies, take the perspective of SMEs' needs for infrastructure concerning use of IT.As resources are more limited in smaller enterprises, and the contexts and conditions for IT use in SMEs are not well known. The perspective taken in this paper is on enterprise needs for infrastructure for IT adoption and use. Formative infrastructure is a way of understanding cognitive and technical arrangements needed for IT adoption and use, depending on IT resources crossing organizational boundaries. The purpose is to study conditions for IT-use in SMEs for a better understanding of how a formative infrastructure contributes to enterprises.

Method
The methodological point of departure and approach in this study is qualitative and explorative. More than 60 interviews are performed within a geographical region. Questions concern needs for infrastructure among SMEs, actors roles, and concepts constituting a formative infrastructure for IT-adoption and use. Data was analyzed for similarities and patterns into themes and topics.

Findings
A theoretical framework for formative infrastructure is presented as a multi theory lens for developing the concept of formative infrastructure. A formative IT infrastructure is constituted by the identified needs among SMEs, and it contains three parts; (1) sensemaking, (2) sensegiving, and (3) service infrastructures. In SMEs there is less of infrastructure and less of overhead services and these are to be found outside the SME. The adoption processes in SMEs differ from the ones in larger enterprises. IT adoption is the process where the formative infrastructure is maintained as well as changed by actors enacting this context. SMEs rely more on external relations in a public infrastructure. In dividing IT infrastructure into two major areas – hard and formative infrastructure, the results indicate that, both are important, but formative IT infrastructure in SMEs is a less known and a less elaborated concept. When analyzing the need for formative IT infrastructure, three types, emerge – sensemaking infrastructure, sensegiving infrastructure, and service infrastructure, as three cornerstones of a formative IT-infrastructure.

Implications
Formative IT infrastructure in SMEs is not a well known concept, concerning IT use in SME's. The need of for formative infrastructure in sensemaking IT adoption and use in SME's rely on external partners and other actors for sensemaking and sensegiving processes. Further research is needed for better understanding of actors and roles as well as arenas for sensemaking IT in SMEs. There is a need for better understanding of conditions for design of infrastructure for IT use and development particularly in SME's, but also in other enterprises and organizations. The emphasis on infrastructure for IT adoption processes will help SME's to more relevant investments.

Keywords: Adoption, formative infrastructure, sensemaking sensegiving, , IT-use, SME

1 INTRODUCTION AND PROBLEM AREA

This paper presents a study of the process of exploiting an information technology (IT[1]) infrastructure in small and medium sized enterprises[2] in a Swedish region. The focus of the paper is to put the concept of formative context by Ciborra and Lanzara (1994) into a an explicit infrastructure perspective.

The key question in this paper is: how can we understand a larger formative context for enterprises investing and using IT, expressed as the formative infrastructure in IT adoption and use? Three sub-questions are used in order to be able to answer the key question in the paper: (1) What needs are there for infrastructure facilitating IT adoption and use? (2) What actors take part in development of infrastructure? Where are the actors located? and finally (3) What would the microperspective of formative context appear to be in a meso- and macroperspective of infrastructure, as in a formative infrastructure for adoption and use of IT?

In this paper we use empirical data, from a Swedish region called Tranås. The project from Tranås is used as an illustration of a formative infrastructure, where there is a process of the decline of the fur industry and where the investments in IT together with other activities and investments, are elements in the changed course of development in the municipality of Tranås. A case study in the shape of a process study is presented for identification and description of important episodes in the Tranås project process. Is the investment in IT a success? Yes, especially rhetorically, as the image of success where the IT investments in Tranås has become an important icon of the success, of the success of investments in the modern. Other investments, in the same size or larger than those in IT has not been mentioned in the same way, but may have created at least the same or more value. So the main case is Tranås with embedded cases of smaller and larger enterprises.

Previous studies show that the use of IT is of importance to productivity and growth of a firm as well as at a national level (Hagén and Zeed 2005, Brynjolfsson and Hitt 2003). However IT use requires a lot of resources as well as social interaction (Gal, Yoo and Boland 2005, Star 2002, Hanseth and Monteiro 1998). IT use varies among enterprises to a large extent depending on size and IT competence, where smaller enterprises have smaller resources in this respect (Persson 2000, Nutek 2004). The focus of the present study is to investigate the conditions for IT use among SMEs. Special focus is on adoption and use, as IT must be used in order for development to occur. IT adoption and use is where the individual makes sense of IT in relation to the work process, as in sensemaking (Weick 1995, Weick, Sutcliffe and Obstfeld 2005). A major premise of social cognitive research is that people act on the basis of their interpretations of the world, and in doing so enact particular social realities and endow them with meaning (Berger and Luckmann 1967, Weick 1995). This interpretation also goes for IT when brought into working life, and the notion of technological frames refer to interpretative flexibility, that artefacts (e.g. IT) may be interpreted in different ways among different social groups, whether they "work" or "don't work", depending on who uses them and for what (Bijker 1995). Relevant social groups interpret and understand the artefact according to their

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[1]IT, as defined by the Information Technology Association of America (ITAA) is: "the study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware."

[2] SME according to the current EU definition are companies with fewer than 250 employees.

purposes and apply their understandings (Bijker 1995, Orlikowski 2000, Orlikowski and Gash 1994). A formative infrastructure then, is the infrastructure for IT integration into work processes, or in more casual terms, the context for IT-use. IT use is a result of an adoption process, where sensegiving and sensemaking, take place.

According to our literature review the dominant perspective is that of implementation of IT. There are no studies explicitly covering the perspective of the users' demands or needs – neither individual nor organizational. The perspective taken in this paper is on enterprise needs for infrastructure for IT adoption and use. Formative infrastructure is a way of understanding cognitive and technical arrangements needed for IT adoption and use, depending on IT resources crossing organizational boundaries. A theoretical framework for formative infrastructure is presented as a multi theory lens for developing the concept of formative infrastructure.

Below we introduce the key concepts in this paper; formative context and infrastructure. In a *formative context* (Ciborra and Lanzara 1994) there is a distinction between the work routines as they are carried out daily in organizations and the formative context within which those routines are formed and receive their meaning and scope in an actual situation of action. The characteristics of formative contexts, are their subtle and pervasive influence in the design and operation of new routines and systems. The open pasted-up nature of systems and routines and the embedded quality of practical knowledge informing human skills are shown to be positive assets to be purposefully exploited rather than handicaps to be removed.

The formative context is the set of the preexisting institutional arrangements, cognitive frames and imageries that actors bring and routinely enact in a situation of action (Unger 1987). A formative context comprises both an organizational and a cognitive dimension and has far-reaching, subtle influences: It constitutes a background condition for action, enforcing constraints, giving direction and meaning, and setting the range of opportunities for undertaking action. Though a formative context provides the ground for routine execution and innuences the creation of new routines, actors are usually not aware of the formative contexts that inform thcir practical and argumentative routines. They tend to take them for granted, except in the case of major breakdowns (Bateson, 1972). The outcome of a formative context in a work setting is a texture of routines, roles, and tasks that come to possess an "aura of naturalness" for those who daily execute the routines in that context. A formative context relates the manner in which individual or collective experience is organized, to choices and actions that can variously punctuate and modify the now of experience.

The formative context constitutes relationships between actors and their work tools in a sort of microecology of stable uses and shared meanings. The basis for competence and the relevant formative context occur in three ways. First, the boundary is shifted between what is tacitly held as background knowledge and what we are aware of as foreground "situational" knowledge *(where* in a specific work situation the focus of attention is explicitly directed to). Second, the basis for the invention, testing, and adoption of new forms of practical knowledge surrounding the use of the system in the work setting is altered. New practices, informal rules and ways of circumventing routines are tried out and set in place within the constraints defined by the new infrastructure and its intrinsic requirements. Third, any invention of alternative practices, any radical departure from existing routines is deeply conditioned by the new mix of background and situational knowledge, the new set of formal and specialized tools required by the system and the local practices, and informal know-how developed by using the new system.

In sum the concept of formative context has a close connection to work routines as the context for the situation of action, and in that sense the formative context has a lot in common with local infrastructure. Also there is a focus on the cognitive aspects of context of adoption,

Looking at the concept of *infrastructure* (Edwards et al 2007), it has a partly different focus in stating that infrastructure is big, layered, and complex, and because it means different things locally, it is never changed from above (top-down). Changes take time and negotiation, and adjustment with other aspects of the systems involved. This could be said to express a micro-perspective on infrastrtucture, in the hands and heads of the actors in processes – and so far in line with formative context. Infrastructures are incremental and modular, they are always con-structed in many places (the local), combined and recombined (the modular), and they take on new meaning in both different times and spaces (the contextual). Three significant aspects of infrastructure are (Edwards et al 2007), firstly, true infrastructures only begin to form when locally constructed, centrally controlled *systems* are linked into *networks and internetworks* go-verned by distributed control and coordination processes. Second, infrastructure formation typically starts with *technology transfer* from one location or domain to another; adapting a sys-tem to new conditions introduces technical variations as well as social, cultural, organization, legal, and financial adjustment. Third, infrastructures are consolidated by means of *gateways* that permit the linking of heterogeneous systems into networks. The key dynamics of infra-structure development are *reverse salients* — critical unsolved problems — may be technical, but are also frequently social or organizational in nature, particularly in the net-work/internetwork formation phase. *Gateways* are defined as technologies and standards ap-plied across multiple communities of practice. The transition from systems to networked in-frastructures requires generic and meta-generic gateways, as opposed to the dedicated or im-provised gateways used in systems. Third, as infrastructures grow they create *path dependence*; as organizations and individuals come to rely on an infrastructure, they adapt to it coupling many small-scale and local elements to the larger commodity service. This phenomenon has positive and negative aspects.

Infrastructure has a different level of analysis compared to formative context, focusing on sys-tems and networks, as in multiple communities of practice, having more of a meso- and ma-croperspective on infrastructure. Also there is a focus on other concepts of gateways as stan-dards applied across communities of practice, and also path dependence as the using com-munities of practice adapt to an infrastructure and rely on it.

One initial conclusion of the comparison between formative context and infrastructure is that the focus on cognitive processes in formative context is not in focus in infrastructure, despite its focus on its local construction and modular and incremental dynamics. So the last subques-tion is what the microperspective of formative context would appear to be in a meso- and ma-croperspective of infrastructure, as in a formative infrastructure for adoption and use of IT.

The focus in this paper is to give a theoretical contribution, where the case study serves as means for study of the phenomenon of what is infrastructure like in larger and smaller enter-prises where organizational borders are a bit fuzzy both within and between enterprises, com-ing to relations among suppliers, customers, product developers. This is a situation where IT-resources enhance the crossing of organizational borders. The understanding of formative in-frastructure contributes to different types of enterprises where infrastructure is an important aspect of outsourcing and offshoring.

The target groups for the paper are IS researchers with an interest in adoption, sensemaking and infrastructure. The present paper can be used for reading and reflection among researchers but also among investigators in municipal service as design conditions in planning. The paper is organized with the next section introducing previous studies and theory.

2 INFRASTRUCTURE FOR IT ADOPTION AND USE

In this section we present background theories and concepts for the present study.

The questions in focus in this paper – also referred to as interesting areas for further investigation by Weick et al. (2005) - concern the micro-macro perspective of analysis, and a better understanding of change and variation in the macro perspective by investigating its influence on the behavior of individual actors, and how these actions generate new macro states at a later time (Weick et al. 2005). The micro-macro perspectives correspond to the concepts of context and infrastructure for enterprises in this text, and a micro perspective has more focus on the individual enterprise. The area of interest is the dynamics of sensemaking and sensegiving in IT adoption and use.

Infrastructure is not a question of whether it is a social problem or a technical one, but more of what combinations of social and technological elements show up in different situations. Infrastructure could be described as is the set of organizational practices, technical infrastructure and social norms that collectively provide for the smooth operation of scientific work at a distance. All three are objects of design and engineering; infrastructure will fail if anyone is ignored (Edwards et al 2007). There is also a local and global issue of infrastructure, as described in the figure beside.
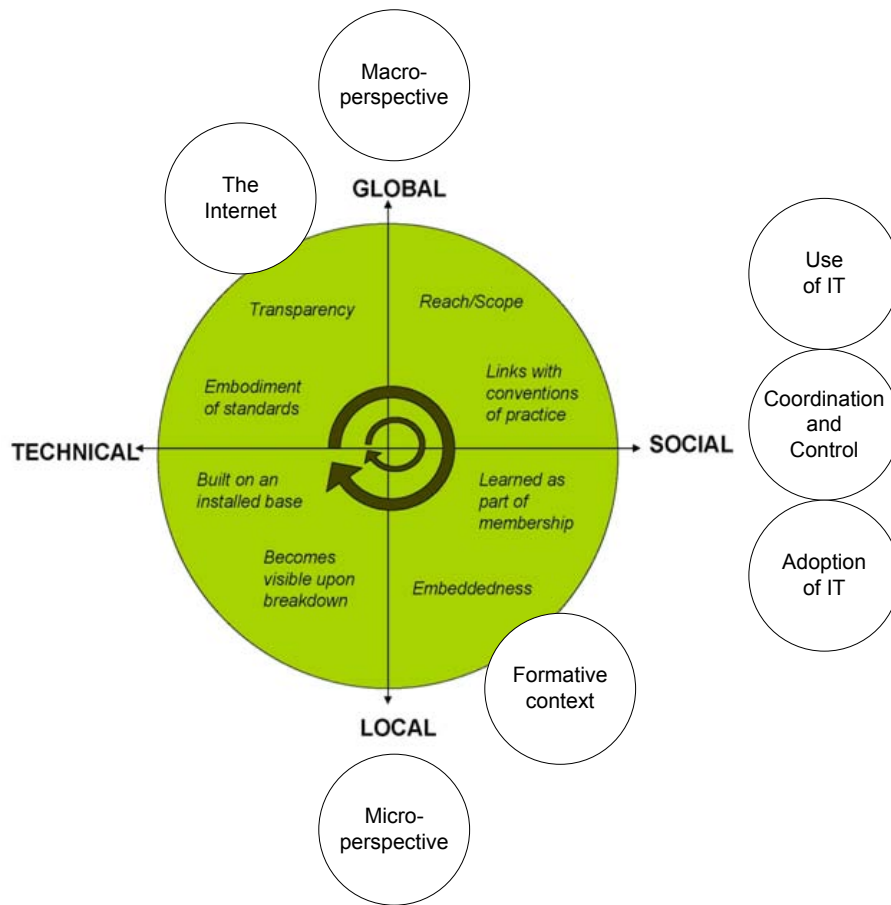
Figure 1 Infrastructure as distrubutions along technical/social & global/local axes (Edward et al 2003) with some central concepts from this paper.

2.1 Adoption as series of sensemaking and sensegiving

The adoption of IT is another key concept in this paper. Our perspective on adoption is process oriented, interpretative and longitudinal. Adoption does not take place as a single decision, but rather as series of sensemaking cycles (Seligman 2006). In these cycles represents perceptions of the technology change, until apparent adoption or rejection actions are performed. To cope with new information and uncertainties, humans develop a "vision" or mental model of how the environment works (sensemaking). Humans communicate these models with others (e.g. partners, employees, investors, potential customers, and suppliers) and gain their support (Weick et al. 2005, Gioia and Chittipeddi 1991). This process: " …involves calling into question an obsolete interpretive scheme, framing a new interpretive scheme in understandable and evocative terms, providing guidance for action toward the incipient change and exerting influence to accomplish it" (Gioia and Chittipeddi 1991 p. 446). When organizations are in need of new interpretation patterns, influential actors may attempt to articulate or advocate their vision or preferred interpretive scheme, thus engaging in sensegiving processes and influencing the sensemaking processes of internal and external stakeholders. Sensegiving processes can take place between top and middle managers and between managers and employees. Sensegiving is different from sensemaking, in that the person trying to *give* sense is attempting to influence other people to perceive and interpret certain actions and events in particular ways. Sensemaking has to do with meaning construction and reconstruction by the

involved parties as they attempt to develop a meaningful framework for understanding the nature of e.g. an intended strategic change. Sensegiving is concerned with the process of attempting to influence the sensemaking and meaning construction of others toward a preferred definition of organizational reality (Gioia and Chittipeddi 1991, Söderberg 2003). Sensegiving can be viewed as reversed sensemaking, that 'sensegiven objects' are sensemade by receivers, as in interaction and sensegiving – sensemaking cycles, that Weick name 'double interacts' (Weick 1979). Although you cannot force adoption onto reluctant users, there is a force in changing e.g. administrative architecture and slowly the culture changes to adapt to that architecture (Wagner et al. 2006). The dynamics of sensemaking-sensegiving is not well known in the context of IT adoption and use in enterprises.

2.2 Formative context (Ciborra & Lanzara, 1994)
Formative context is a key issue and a key concept in this paper, introduced in the first section. A formative context is defined as 'the set of preexisting institutional arrangements, cognitive frames and imageries that actors bring and routinely enact in a situation of action' (Unger, 1987; Ciborra and Lanzara, 1994 p.613). It thus comprises both the interpretive frames and the organizational routines that influence problem solving in organizations. Learning new routines is a single-loop process. Restructuring a context implies double-loop learning (Argyris and Schön, 1996).

The context is "formative" in that it shapes the ways people perceive, understand, make sense, perform, and get organized in a situation bounded in space and time. It is "formative" because it may help people see and do things in new ways, or, on the contrary, make them stick stubbornly to old ways.

When enacted in a situation of action, formative contexts are expressions of a social cognition that transcends the individual. Such cognition may well be embodied in material or symbolic artifacts, organizational structures and procedures, institutional settings, and, most crucially, in the relationships or "couplings" binding actors and their work tools in a sort of microecology of stable uses and shared meanings. Thus, by introducing the notion of formative context in organizational analysis, we want to capture both the institutionally embedded quality of social cognition and the cognitive dimension of institutional and organizational arrangements.

Formative contexts posses a double nature. On the one hand, they appear to be highly stable and inescapable, given their wishy-washy, sticky pervasiveness; on the other hand they can be regarded as the culture bed, at the routine level, for experiments in organizational restructuring and innovation, within certain economic and technical constraints, themselves subject to local revision and manipulation.

Formative elements in context in terms of coordination

The concept of *organizing* is an important verb in describing major actions taken by humans in firms in order to generate appropriate outcomes: "To organize is to assemble ongoing interdependent actions into sensible sequences that generate sensible outcomes." (Weick, 1979, p. 3) When people act in organizations, they also create and recreate fundamental elements of social interaction: meaning, power, and norms (Giddens 1984). These concepts make an important contribution to the understanding of organizing, an organization and its information systems. An organizing act can also be viewed as coordination. One important purpose of

coordination is to formalize actions thereby reducing undesired variation, and to control and to anticipate actions (March and Simon, 1958; Mintzberg, 1983; Thompson, 1967).

However, to reduce variation in organizations by formalizing action, can be in conflict with the demands for flexibility that are highly ranked in the organizational agenda. It is probably a question of reducing undesired flexibility and allowing and encouraging desired variation. Time and actor play a pivotal role in desired and undesired variation which poses another challenge. Organizing is also a question of accessing one's own or other organization's resources. Stability is consequently an important aspect of organizing and organizations. (Melin, 2003). There are three activities that are necessary in order to perform coordination: coordination through standardisation, coordination through planning, and coordination through feedback. The latter researcher also identifies a set of coordination mechanisms, partly based on March and Simon's (1958) work, mutual adjustment (1), direct supervision (2), standardisation of skills and norms (3), work processes (4), and results (5) (Mintzberg, 1983, 1998).

There is a need to focus on the *process of coordination*. In doing that, one needs to focus on prerequisites of coordination, human action and results. Communication, information and information systems are certainly related to coordination. To *coordinate is to act and to communicate*, and acts are performed by and through information systems. It is important to understand the logic, principles and patterns of coordination in firms and their relationship to external actors in order to understand information systems and to identify information system functionality and use that are harmonious with the desired coordination from an organizational point of view.

Coordination is one of the main activities in organizations and enterprises with lots of expectations and meanings tied to it, having both formal and informal connotations. Both relevant for understanding of IT adoption and use.

In general, and specifically in the meaning of the cyberinfrastructure framework, *infrastructures are not systems*(Edwards et al 2007). Instead, they are networks or webs that enable locally controlled and maintained systems to interoperate more or less seamlessly. It is typically only in the consolidation phase, with the appearance of standardized, generic gateways, that most technological systems become genuine infrastructures, i.e. ubiquitous, reliable, and widely shared resources operating on national and transnational, scales. Thus we (Edwards et al 2003) define a spectrum running from systems (centrally organized and controlled) to networks (linked systems, with control partially or wholly distributed among the nodes) to webs (networks of networks based primarily on coordination rather than control).

Formative Context – the need to further develop the concept
Context, as used by Ciborra & Lanzara (1994), is not a precise concept and does not refer to if it is a context of a small workgroup or a large organization. We find a need for a more distinct concept of context in using three kinds of infrastructure – local, corporate and public (Weill and Broadbent 1998) and distinguishing between micro-, meso- and macrostructures.

In this paper we focus on the context of adoption and use of IT. The effective adoption of new systems can only occur through processes of learning where organizations become competent in smoothly turning anomalies and novelties into innovative patterns of behaviour. This is what we would refer to as a formative infrastructure for adoption/sensemaking (or not), as one part of a formative infrastructure. The other part is the sensegiving infrastructure for generating relevant innovations - designs etc. So far Ciborra and Lanzara (1994) only focus on the

sensemaking element, but an important part of the formative infrastructure is also the sense-giving element.

Formative context was generated with a focus or perspective of individual enterprises and the forming of work routines. We argue that the Internet has changed conditions and work routines for collaboration, communication and coordination among and within enterprises. Ie it has had an impact on work routines in enterprises or at least created an option for impact on work routines concerning eg relations with customers and suppliers. Conditions have changed also concerning contents and thus input into sensemaking processes. With new collaborators one can assume that there also is a change in sensegiving processes.

Now – and in this paper – focus is more on infrastructure and need for infrastructure as a larger context for enterprises, and from a meso- and macroperspective. The focus in the paper is on creating a framework for the concept of formative infrastructure, where the Internet has an important role being an efficient and standardized backbone for communication with low barriers to entry.

2.3 Infrastructure, structuring enterprises, organizations and societies

Societies as well as enterprises and organizations build infrastructures, of course, and because of their endurance in time, infrastructures then become the more important force in structuring society. This point is similar to Giddens' concept of structuration which he once defined as "how it comes about that social activities become stretched' across wide spans of time-space" (Giddens 1984 p xxi). This gives an idea of the reciprocal relation between infrastructure and activities of IT use as in structuring the use of IT. Infrastructure is a concept with no single or simple definition, as it most often is thought of as something in the background. In a more commonsense description "infrastructure is something that other things "run on" (basic physical and organizational structures) and are substrate to events and movements – e.g. railroads, highways, plumbing, electricity, and more recently, the information superhighway. Structures are needed for the operation of a society or enterprise. Good infrastructure is by definition invisible, part of the background for other kinds of work" (Star 2002 p 116). The properties of infrastructure is that which is embedded; transparent; having reach or scope; is learned as part of membership; has links with conventions of practice; embodies standards; is built on an installed base (and its inertia); becomes visible upon breakdown; and is fixed in modular increments, not centrally or from an overview (Star 2002).

Sharing resources

Infrastructure is about sharing resources where standards become important, e.g. for communications, data definitions, interfaces between databases and applications – and for use of IT and IT-related concepts. Use of IT takes place in a social context as a socio-technical system, and the term soft infrastructure is of great interest as it also considers use aspects. As actors are inducted into a social infrastructure and its constituting institutions, they go through a process of socialization which entails the internalization of role-specific knowledge and language, values and semantic fields that facilitate routine sensemaking and interpretations and enable knowledgeable conduct within an institutional field (Gal et al 2005; Orlikowski 2000). In this paper we separate Soft IT infrastructure from hard IT infrastructure, referring to the conditions for using the hard IT infrastructure, the means for knowledgeable use of IT, e.g. resources for communication, analyzing and acting on market signals, learning, offering or ordering service, among other things.

Microperspective and Microsystems

A microsperspective (Quinn 2002, Melin, 2003, Nelson et al 2003, 2008) starts with the detailed processes and practices that constitute the daily activities, in the smallest organizational parts, "where work is done". Microprocesses occur in the small, functional units in the frontline where most of the contact with people and services and products are delivered to most people. A microprocesses refer to little groups of people who work together on a regular basis and produces services or products to different groups of customers. These groups or microsystems have professional as well as economic goals; cooperative and collaborative processes shared information and create collectively the results of the unit (Nelson et al 2003).

In this paper a special focus is on adoption and use where new knowledge must be used in order for development to occur. Adoption and use is where the individual makes sense of new knowledge in relation to the work process, as in sensemaking (Weick 1995, Weick et al 2005). A major premise of social cognitive research is that people act on the basis of their interpretations of the world, and in doing so enact particular social realities and endow them with meaning (Berger and Luckmann 1967, Weick 1995). This interpretation also goes for new knowledge when brought into working life, and the notion of technological frames refer to interpretative flexibility, that artifacts (e.g. IT) may be interpreted in different ways among different social groups, whether they "work" or "don't work", depending on who uses them and for what (Bijker 1995). Relevant social groups interpret and understand the artifact according to their purposes and apply their understandings (Bijker 1995, Orlikowski 2000, Orlikowski and Gash 1994). A *formative infrastructure* then, is the infrastructure for integration into work processes, or in more casual terms, the context for use of new knowledge. Use of new knowledge is a result of an adoption process, where sensegiving and sensemaking take place and this occurs primarily among actors in microprocesses.

IT- systems – infrastructure in micro- and macroperspectives

As microsystems collaborate they have a need for communication and coordination, not only among different professions in the same microsystem (local infrastructure), but also with both similar and different professions in other microsystems and for the control of efficiency and quality in business processes. So a microsystem has a need for a well working local infrastructure together with a well working meso and macro as in corporate and public infrastructures. Typically in a local infrastructure there is eg local IT for business processes, and in corporate infrastructure there is eg network services, large-scale processing, e-mail. In a public infrastructure there is eg the Internet, telecommunications, network service providers, industry networks (Weill and Broadbent 1998).

2.4   Perspectives on sensemaking and sensegiving

Individual perspective on sensemaking (microperspective)

From the perspective of the individual, IT-use is about figuring out how new IT can be integrated in the actors' specific organizational processes getting the new IT into the actors' mental models. One interesting aspect is how people understand news in terms of what is noticed is classified as being 'like' or 'unlike' as compared to earlier experience, a comparison of what is noticed and what is understood (Weick 1995). So what is not well known are questions of how social environments influence sensemaking, and what environmental conditions constrain or support IT adoption (Seligman 2006).

Organization and society perspective on sensemaking (macroperspective)

From the perspective of organization, the application of new knowledge is about the social context for its application or use, the cultural and social context for mental models to develop, instantiated by business processes. Communication and socializing relate to the social impact of and on knowledge application. What is not yet well known are the conditions for this communication and how it affects adoption, conditions as forms for communication and interaction (Seligman 2006). One part of sensemaking is about how persons over time influence their work environment, and then are influenced by it, as the environment is a source of stimuli. The environment has an impact on the users' attitudes towards knowledge application where the knowledge of the experience of others is one part, and sensemaking is to incorporate them with existing mental models in one direction or another (adoption or rejection). A formative context (Ciborra 2000) refers to the cognitive frames and institutional and technological arrangements in e.g. an organization. This context works as both a resource and as restrictions for actors in the organization in their adoption. In contexts where limited learning and innovation occur, the organization is incapable of enquiring into the existing formative context (Henfridsson 2000). So one important condition for new knowledge to be meaningful is the extent of learning which occur in alignment of adoption, norms and experiences of the organization. Making the most out of adoption, an organization needs to trigger sensemaking processes around the new knowledge and technologies. Common parts of organizations infrastructure are traditionally described in different contexts such as public, industry, corporate, and local (Weill and Broadbent 1998, Ciborra et al. 2000, Hanseth and Lyytinen 2004). From the perspective of the microsystem, or the local infrastructure, the elements of the other kinds of infrastructure may differ, where it sometimes may exist well working macro and meso infrastructures, and sometimes not.

2.5   What is a formative infrastructure for adoption and use of IT?

The context or infrastructure for learning and teaching play an important role for outcomes to occur (Hammick et al 2007) containing the elements and the dynamics for understanding the interplay between individuals and their organizational and social context. Realist review[3] (Pawson et al 2004) seeks to 'unpack the mechanism' of how complex programmes work (or why they fail) in particular contexts and settings. Realist evaluation asks of a programme – 'what works for whom in what circumstances, in what respects and how?' The quest to understanding 'what works?' in social interventions is, at root, a matter of trying to establish causal relationships, and the hallmark of realist inquiry is its distinctive 'generative' understanding of causality. The generative model calls for a more complex and systemic understanding of connectivity. It says that to infer a causal outcome (O) between two events (X and Y) one needs to understand the underlying generative mechanism (M) that connects them and the context (C) in which the relationship occurs.

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[3] The 'realist' perspective - Realism is not a research method but a methodological orientation; that is, a particular approach to developing and selecting research methods.. Examples of realist inquiry can now be found in every social science discipline, for example, law (Norrie, 1993), psychology (Greenwood, 1994), economics (Lawson, 1997), soci ology (Layder, 1998), management studies (Ackroyd and Fleetwood, 2000), geography (Sayer, 2000, part 3), nursing (McEvoy and Richards, 2003), comparative historical studies (Steinmetz, 1998), and evaluative inquiry (Pawson and Tilley, 1997; Henry, Julnes and Mark, 1998; Mark, Henry and Julnes, 2000).

Interventions are always inserted into existing social systems that are thought to underpin and account for present problems. Improvements in patterns of behavior, events or conditions are then generated, it is supposed, by bringing fresh inputs to that system in the hope of changing and re-balancing it. A critical feature of interventions is that as they are delivered, they are embedded in social systems. It is through the workings of entire systems of social relationships that any changes in behaviors, events and social conditions are effected (Pawson et al 2004). Interventions are fragile creatures. Rarely if ever is the 'same' programme equally effective in all circumstances because of the influence of contextual factors. A key requirement of realist inquiry is thus to take heed of the different layers of social reality that make up and surround interventions.

There is local refinement and modification of programmes through inter-organizational knowledge exchange (Pawson et al 2004). The result is that the overlaying of formal and informal programme theory can become massively convoluted, especially if the service change in question is itself about promoting communication and collaboration! The key point here is that informal knowledge exchange about a scheme may sometimes standardize it and may sometimes fragment it, but will always change it, so we should expect the 'same' intervention to be delivered in a mutating fashion. The outcomes are dynamically shaped by refinement, reinvention and adaptation to local circumstances. So what is the denotation of 'local'? And in the continuation what is the context for 'local', ie what is the formative infrastructure for interventions to occur in the 'local'? This focuses on the meaning of what is local – with the microsystem as one of the candidates, and in the microsystem there are mechanisms for sensegiving and sensemaking, ie the interplay between the individual actor and its closest context.

3   RESEARCH APPROACH

The methodological point of departure and approach in this study is qualitative and interpretive in line with the explorative research aim. The work performed corresponds to central concepts and ideals in interpretive and qualitative research, such as interpretation and pre-understanding. An important point of departure in the interpretation of IT and infrastructure is that reality is a social construction by a human actor (Berger and Luckmann 1967, Walsham 1993). Interpretivism can be seen as an epistemological position concerned with understanding reality and a position that knowledge is a construction and therefore subjective (Walsham 1993). One can also relate the present work to the principles when conducting interpretative studies (Klein and Myers 1999). We acknowledge the importance of hermeneutical ideals, the importance of context, the IT and the regional context and the principle of multiple interpretations (of e.g. IT). In our study we rely heavily on qualitative, face to face, interviews as a source to generate empirical data.

The empirical data is generated based on case studies. We regard the region, Tranås, as the major case, with several embedded (multiple) cases within (cf. Yin 1994). The embedded cases are enterprises and municipal actors.

The empirical data in this paper is based on qualitative, face to face, rather open ended and informal (cf. Patton 1980) interviews. The first series of interviews with nine enterprises were conducted in 2000 and in 2001. 24 interviews that were carried out during late autumn of 2003 and winter of 2004, with municipal politicians (2), municipal managers (2), municipal officials and project leaders (4), managers in large and small enterprises in both industry and

trade (10), and also representatives from professional and industrial organisations (3). During the interviews the respondents were asked to tell their story; how they perceived the process in hindsight; what events they regarded as critical; the general IT situation in Tranås; implications of the TRAMAN implementation and future intentions in relation to TRAMAN and in general. During 2005 interviews were carried out with municipality IT-officials (4), general meetings with enterprises in Tranås for presentation and discussion of results (2). Also during 2005 group interviews were carried out with persons from different lines of business as trade, industry, and service, in all 21 persons from 21 companies with less than 50 employees. These interviews were performed in order to gather data from smaller companies. During 2006 interviews were made with five managers in three SMEs. The interviews covered managers focused on e.g. IT, marketing and sales and production.

The research questions are grounded in a socio technical perspective aiming towards understanding and interpretation of the complexity and intertwined nature of IT infrastructure. The theories about e.g. sensemaking, sensegiving, and social infrastructure have been a guiding our work in sensitizing concepts and interpreting processes (c.f. Klein and Myers 1999; Walsham 1995). The questions are examined in a case study as the research approach suggests, and with open-ended questions the answers given by the respondents were rich in experiences. Although the interviews were performed in a similar way there was great variation in answers and follow up discussions. In the interviews there were also opportunities to go deeper into subjects that were of special interest. In the analysis a descriptive approach has been employed (Klein and Myers 1999) to the interview transcripts. In addition to interviews, data were collected from documents such as marketing documents, policy documents, project reports, data stored in databases, and web pages – to get a more varied and truthful view of actors perspectives as a kind of triangulation (Denzin and Lincoln, 1994).

In the interviews we looked for similarities and patterns, using tables and organizing texts in a recursive way, where datasets are summarized, those summaries are then further summarized, and so on. In the summarizing activity ideas were checked with secondary data. Questions and answers were put into large matrices for finding topics and themes in both a textual and a more graphic way. These themes and topics then were analyzed and aggregated in order to arrive at a set of themes that were common or recurring. Then data were reviewed in an iterative process of interpretations and reflections.

The long period of data collection and the recursive analysis of data – also involving feedback from interviewees - together with the relatively large amount of interviews with people from a broad array of IT use, contribute to make the results trustworthy.

In the present study we have no incentives to generalize results in a statistical sense. Analytical generalizability is more in line with the epistemological stance taken in this paper (cf. Patton 1980; Walsham 1993; Yin 1994) when we try to make theoretical contributions. Valid abstraction is an aim in this paper together with analytical strengths and making sense of the field, interpretations, artifacts and actors studied.

4   BACKGROUND OF THE TRANÅS CASE

The study object in this paper is the municipality of Tranås in Sweden, and its 18 000 inhabitants (http://www.tranas.se/).Until the end of the 1980s the fur industry was a very important business sector in Tranås with around 2 500 employees. For different reasons this industry

collapsed in the late 80s causing many problems at the municipality level such as unemployment, diminishing population, less taxes paid etc. The situation called for action in order to facilitate growth. One of the early actions in Tranås was to invest in regional development including an all-fibre network (broad-band) in order to connect enterprises, people, associations, and the public sector in the TRAMAN[4] project. There are 1 752 registered enterprises in Tranås, most of them small. 1 137 have 0 employees, 585 enterprises have 1 to 50 employees. The majority has no IT-competence of their own; they rely on suppliers for services and support in order to serve their customers in turn.

The municipality Tranås was forced into extensive changes in enterprise structure as the dominating industry collapsed due to changes in cost and demand patterns. The municipality has acted in a proactive way to handle changes. Among other things there have been investments in a broadband network, connecting citizens, enterprises, associations and public service. An enterprise centre has been built up, together with education at university level in economics and informatics.

There are no clear rules of how to pursue regional development and neither there are any standards for evaluation. The investments made in Tranås has been like a field laboratory and this is why it is interesting to know more about what has been done and what is being done in Tranås. The local strategy for growth in Tranås states that "Tranås shall exploit the new information technology in order to create a long-term attractive and competitive society for and in cooperation with citizens, enterprises and public sector". Tranås has invested in infrastructure and in recent years there has been a powerful growth in communication via the Internet and other nets (intra-, extra-, internal-) and enabling communication which is not limited in time and place and thereby also enabling new ways of cooperation and coordination. New services has become available via the Internet and also new opportunities for business and product development.

In much of the referred literature we see that IT is a necessary but not sufficient enabler for strengthening enterprises and increase their competitiveness. Communication and collaboration in and between enterprises is essential for business growth, where one medium is technology as enabler of relation-building, between social actors in establishing and maintaining networks. So there are two perspectives on networking – one technological and one social. In adoption and use of IT we see some actors facilitating the process and participation in inter- and intra-organizational networks are reported by the enterprises in Tranås to have impact on change and development and in the study we want to know more about what IT-related action do enterprises pursue and what are the consequences of this action. As most enterprises in Tranås are small and mediumsized, it is a special opportunity because very little is known about this situation in small and medium sized enterprises, how they absorb and adopt new technology for business development and growth.

4.1   TRANÅS

Tranås is ranked as a sparsely-populated rural district. Tranås has some 18,000 inhabitants and is situated in southern Sweden (http://www.tranas.se/). Until the end of the 1980's the fur

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[4] Tranås Metropolitan Area Network

industry was a very important sector of the industry and trade in Tranås with around 2500 employed persons. For different reasons this industry collapsed in this era causing many problems at the municipality level such as unemployment, diminishing population, less taxes paid etc. Large-scale concentrations were made in order to attract new industries and increase employment, whereof the IT platform, the TRAMAN project (Tranås Metropolitan Area Network) was a major concentration. In a governmental proposition from 1999/2000: "An IT community for everyone" a call for a national build up of broad band was established where a fibre optical infrastructure should be implemented not later than 2005. However, in the Swedish municipality of Tranås, this was done some years earlier. In the middle of the 1990's the municipality made investments in regional development including an all-fibre network ("broad-band") in order to connect enterprise, persons, associations and public sector in the TRAMAN project (Tranås Metropolitan Area Network). In the middle 1990's the municipality made investments in regional development including an all-fibre network ("broad-band") in order to connect enterprise, persons, associations and public sector in the Traman project. The Traman project is an investment in infrastructure where the municipality builds a network with a global action range. It contains a fibre network and services provided by suppliers in the open market. Examples of services offered are back-up service, web design, webhotel, access to software (ASP), GIS and others. The network connects enterprises, many of the citizens, the municipality administration.

From then on several new companies have established their businesses in Tranås and others have developed partly new lines of businesses, all adding up to a diversified commercial sector, less unemployment and a stabilized population. Businesses have developed and grown during this period. In sum there has been quite a positive change in many aspects in the situation in Tranås despite (or thanks to) the big problems some 15 – 20 years ago. Summary of some of the case(-s) as examples of investments made in this period to support a positive development, described in some key word of sensemaking and sensegiving:

Table 1 Overview of projects in Tranås

Case	Main issues - aim - outcome	Time started	Activities and actors in Sensemaking	Activities and actors in Sensegiving
Tranås	Stopping decline in municipality Tranås is later on ranked as one among the most enterprise friendly municipalities, with a positive balance in the budget.	1996	Via agents like TUC, Traman, and TU	Infrastructure for sense-making Support of agents
Traman (4.2)	Providing net- access – private or/and the Internet Most large enterprises connected.	1997	Activities of information, meetings, projects with actors in enterprises and society	Drivers of the Traman project Physical net access
TUC (4.3)	Provide Tranås and enterprises with relevant and needed competence. A comprehensive development into many competence areas through courses and projects.	2000	Education and competence development for students - support of sensemaking processes among students	Programs and courses corresponding to ex-claimed needs among enterprises

Case	Main issues - aim - outcome	Time started	Activities and actors in Sensemaking	Activities and actors in Sensegiving
Smart Community (4.4)	Politicians, enterprises, education, healthcare, culture and others join in a common way supported by IT to create a human, well functioning environment for growth." Some projects pursued, now revitalizing the idea into new projects.	2002	IT in municipality development	Social and formal processes in project activities in combination with IT
TU (4.5)	Stimulate and support growth in and of enterprises in Tranås. Reported impact and goodwill from first year of activity, and pursued extensive activities.	2006	Is known among enterprises, but not with a large impact, expectant attitude	Extensive activities about information, seminars, meetings, projects, - high level of activity. Arena for collaboration and support in and of enterprise development
TOP (4.6)	Web-based solution for safe and secure communication. Some enterprises and municipal departments connected.	2002	Collaboration in design of solution	Implementation and operation of the service – information and marketing The application for safe communication
KÖBYT (4.7)	Collaboration among small municipalities in the region for developing infrastructure for services. Projects pursued, the initiative replaced in 2006	2001	Collaboration and negotiation among parties	Arena for collaboration in connection to investments in IT infrastructure
Thesis project (4.8)	Reach conclusions on how to pursue efforts to develop enterprises in connection to IT in 10 cases, reported in 10 student theses.	2001	Focus on conditions for enterprise development in connection to IT	Little direct, but the project contributed to the image of the modern, evolutionary e-municipality

In short there are some 1600 companies in Tranås, of which 390 have more than one person employed, only 10 companies have more than 100 persons employed. Around 300 companies are connected to Traman (autumn 2003), see below. Of the 184 companies in Tranås Enterprise Society (Tranås Näringslivsförening) there are some 30 without e-mail addresses or PC's.

Other significant actors in Tranås are "Tranås Enterprise Society" (Tranås näringslivsförening), "The Swedish Federation of Trade" (Svensk Handel, http://www.svenskhandel.se/detail.asp?Area=Hem&Category=Brief%20in%20English&Article=1762), Sommenforum (http://www.sommenforum.com/), the Confederation of Swedish Enterprise (Svenskt Näringsliv, http://www.svensktnaringsliv.se/index_english.asp)

Several enterprises in Tranås – both large and small – have foreign owner and/or are part of larger company groups. Many companies are still family owned but they see other forms of

ownership emerge which also give new options for development and provision of both capital and competence. Several enterprises have needs for communication and coordination with mother- and sister companies as well as with both suppliers and customers. Most of these enterprises regard the development of IT-based interaction between suppliers and customers among competitors but are frustrated over their own lack of insight or competence in the field to be able to develop business ideas integrating new technology with business development.

In the following text the cases are presented in more detail.

4.2   Traman

TRAMAN is a local network that provides the industry, the residents and the local municipality (Tranås Kommun) with a joint infrastructure for IT communication. TRAMAN also has a public website which serves as a joint forum, where the companies can exchange information and contribute to the development in the IT area. Tranås Kommun also has provided the companies with training and support. According to some of the interviews, the access to a fast connection and the IT-knowledge provided by TRAMAN could be an advantage when e g implementing an extranet.

The access to TRAMAN and the support from Tranås municipality makes for an advantage for companies in Tranås especially those disadvantaged by lack of technical, competence and financial recourses, with a perceived negative impact on IT investments and exploitation. Despite this situation there are still many SME's not connected to Traman. And among the connected companies the connection is most often used only for internet access.

The story behind this early implementation is as told in most of the interviews:

> One afternoon the IT manager of the municipality was on his daily jogging tour. He was an athletic and coach for youth teams. On his tour his thoughts were "cleared" and he realised that the thing to do for Tranås was to implement broad band for the local government as well as the business community. And it should be for free. Said and done. At the following local government council, (kommunfullmäktige) he was allowed to present his idea. A historical decision was made this night when a united local government council (fullmäktige) approved. Only some days later, excavators were busy digging the first holes.

The central person in the project – according to most of the interviews – was the IT-manager of Tranås municipality office. All contacts started with him, and along the process other persons in his staff got in direct contact with customers or prospects. In the beginning there was much communication in many ways, ranging from personal contacts on a friendly basis to large information meetings with all companies in Tranås invited. Also there were project groups and work groups performing tasks touching many aspects of needs, options, delimitations etc in connection to local networking. The project started with the idea in the head of the Tranås IT manager to build a local network in Tranås made accessible for both enterprises and individual members of the society. The next step was to put it as basis for a decision and support in the municipal council. The question got a very fast handling and the decision was made in an unusually short time, and the building process started immediately.

As one of the many activities in the project, there were reference groups with people from different enterprises in the municipality together with municipality officers, working on different aspects of cooperation between them and in some connection to the Traman project. Later on pilot projects were accomplished before going into continuous operation. In order to reflect the answers in the conversations, they are collected in groups of actors with similarities in the answers – municipality politicians, municipality officers, interest associations and companies.

There are a couple of clearly distinguishable categories of utilizing enterprises, where the most active are found among the larger producing together with service enterprises. There are some 1100 registered enterprises in Tranas, and some 150 of these are connected to Traman. More than 90% of these enterprises have less than 9 employees and around 65% have one employee, around 10% 2 employees, less than 10% have 3 employees. So the majority are very small enterprises.

Properties among enterprises not connected to Traman are, besides size, trading businesses, enterprises with few relations locally in Tranås but also subsidiaries within larger enterprises with headquarters in another place. Also franchise enterprises and shopping stores that are parts of national or international business operations where there is an internal IT-infrastructure, are not connected to Traman. Among the smaller enterprises there were no immediate business benefits and they found the cost for connecting a little too high, according to the interviews.

4.3   Tranås Education Centre (TUC), http://www.alltomtuc.se/

In collaboration with universities in southern Sweden, foremost Jönköping International Business School (JIBS) and Linköping University, TUC arranges undergraduate education. Professional educations are also arranged on site or as distance courses via web and videoconferencing. In that way the options of modern education comes local. TUC's ambition is to be a meeting place for education and competence development, as an engine for growth with a combination of local arrangements and as broker of education corresponding to identified needs. Examples of the educational programs performed in cooperation with JIBS are Production logistics, Marketing economics, Business enterprise and entrepreneurship.

Enterprises in Tranås have expressed competence as an important and necessary element as a facilitator for growth, where education is an important part. Besides education projects for development of competence and growth are pursued. These projects consists of actors from enterprises, and organizations like real estate, Enterprise council, Swedish Retailers, Enterprise Association in Tranås, Tranås Educational Council among others, together with municipality officers. TUC is also a member of the Science Park system and cooperates with Location Scandinavia, and with consultancies for business establishing and financing.

Besides the education programs there are courses under the theme of betterment, eg Better production, Better business design, Better sales. Seminars, workshops courses in the area of leadership, sales, business development and design, challenges for family enterprises, are offered and some of them in a project form with mentors for the participants in order to combine education and development activities within their own enterprise.

Other examples of support for development of citizens and enterprises are:

Create additional sale in small enterprises within retail and commerce - aiming at increasing competence and stimulate networking within in retail in Tranås. Lectures, seminars, breakfast meetings, in order to stimulate the invention of new arenas for networking.

One Tranås – one message - aiming at creating and distribution of a clear and consistent message of what Tranås is and can offer enterprises, organizations, and citizens thinking of moving to Tranås, to create conditions for growth and strengthen competitive forces. Contains three parts – Portal, Marketing, and Inflow of competence, and networking is an important element in this accomplishment.

Competence and entrepreneurship – provide the enterprises in Tranås with courses, for those who wants to start an enterprise or recently have done so. The project will map the need for competence among enterprises in the Tranås region. The project will strengthen TUC's coordinating tasks in supplying competence and also to develop efficient administrative routines in this endeavour, like websites, newsletters, among other things. Also this project will invest in IT and IS to enhance knowledge- and information processes, all day round.

Summer Design Office in Tranås - aiming at the conditions for growth among enterprises in Tranås, with a special focus on developing design thinking within the municipality and among enterprises. Activities deal with competence and employees to handle development and refinement of products. Ideas are to be generated from enterprises or organizations in the region. Seminars are arranged for enterprises with themes of importance of design in business and product development. Design refers not only to product design, but have a wider meaning in also referring to production, logistics, and environmental aspects.

Development of SME's in hotel, restaurant and chocolate business - aims at developing conditions for hotels, and restaurants (with chocolate as a special case of restaurant), by increased competence in IT, and develop networks for collaboration and exchange of ideas, and to create better conditions by common marketing and sales processes. Networking will focus on exchange of services, and experiences within all areas, but especially those in focus of the project.

Design – a tool for growth - focus is on design and its influence on growth, aiming at increase interest, knowledge, and use of design. In the project the participants will increase their understanding of the breadth of design and importance as developing tool and how design of form and content contribute to growth. In the project enterprises and organizations will have access to knowledgeable designers (eg persons in Summer Design Office).

4.4 Smart Community

A smart community is "a geographical area, eg a municipality, where politicians, enterprises, education, healthcare, culture and others join with all citizens in a common way supported by IT to create a human, well functioning and sustainable society and a unique environment for growth." (Mayor of Tranås)

The World Foundation for Smart Communities is a nonprofit educational organization founded to promote the concept and facilitate the implementation of "smart communities" -- communities using information technology as a catalyst for transforming life and work to meet the challenge of the new millennium. Founded in 1997, the Foundation operates in partnership with the California Institute for Smart Communities at San Diego State University. The goals and objectives of the World Foundation are accomplished in part by providing a worldwide forum for corporations, government, academe, associations and community lead-

ers to meet and discuss the best applications of IT in emerging smart communities, and innovations in governance, particularly private/public partnerships. Additionally, seminars, tutorials, and a "boot camp" for key government and community leaders, and a clearinghouse of smart community projects are accessible along with reports, monographs, white papers and other articles of interest. (http://www.smartcommunities.org/about.htm)

There are three broad areas of concern facing all of us as we think about the role of communications in the social and economic development of our region: I.   Cooperation between the private and public sectors is essential to achieve the benefits that technology affords us. II. The challenge is not building the infrastructure, but rather, ensuring the benefits are widely understood and that the systems are used by all sectors of our economy. III. Cities must develop their own bold telecommunications policy, and do so in cooperation with their neighbors.

"Traman was a decision already taken when I first started working here. It was more of a reality, but then came Smart Community as overarching the technology in Traman with softer elements, in our own version we call it 'the good life', ie it is about cooperation within the municipality, between municipalities and further on in society. Focus is on collaboration across borders, communication in and between munipality officials, enterprises, organizations, and individuals.

The city network Traman, university educations, Firemen-on-town, e-businessproject for enterprises in Tranås, are all examples of Smart Community activities, pointing at collaboration and benefits for many. In Tranås Smart Community – The Good Life is about Collaboration-Confidence-Democracy-Relations and Affinity-Belief in the Future. In the project Smart Community Centre, which is an innovative platform for pursuing ideas like continuing Smart Community activities, Municipality-on-Call open all day and all days and where citizens in Tranås can call for help and involving police, healthcare, rescue centre, SOS alarm, security companies, and others.

4.5   Tranås United, TU

TU is a registered company owned by the municipality of Tranås, organizations and enterprises in Tranås, by a foundation. TU has three main targets – to enhance and support development in existing enterprises, new enterprises, and actively promote enterprises to move to Tranås. For existing enterprises TU supports increase of strategic competence, mapping it and initiates competence increasing activities with organizations in that business. This includes seminars, networking, financing and more.

Concerning the establishment of new enterprises, TU is to support with mentors and advisors to those wanting to startup their own enterprise. Networking with advisors and financers. TU also will work with stimulating the creativity, inventiveness and entrepreneurship among children and youths in collaboration with schools and enterprises. To promote enterprises to move to Tranås, TU is to market the municipality as attractive for both enterprises and individuals and families. Other issues are to work with municipality officials to offer attractive land for housing and for industry. TU will work as project coordinator and promote resources when new enterprises establish.

Examples of activities are the establishment of a communication plan, and an establishment service. Other acitivities is to create and maintain work processes for the support of new enterpises with mentors, advisors (one door). Also create arenas for people with similar trades, tasks, interests to network, meet, exchange experiences. Other activities aim at handling lack of competent manpower, and to address people with a history in Tranås to move back with information, offerings of tandem recruitment.

4.6 TOP - Tranås Optimal Portal

Development and use of IT demands safe communication. TOP is an overarching project aiming at increasing citizens access to municipal activities in a more efficient way than now. One project on trial is where services for employees in municipal schools, students and parents are developed. In total 5100 users are connected to this portal. Services are internet access, calendar, e-mail, access to files and for communication between students, teachers and parents in closed and open websites. Classes can communicate within and with other classes, discussion for a, access to intranet webservices, and surveillance systems.

4.7 KÖBYT

This is a cooperative project between the municipalities Kinda, Ödeshög, Boxholm, Ydre, and Tranås – KÖBYT as in the initial letter of each of them. It started 2001 and is managed by a steering committee with the chairpersons in the municipality board, municipality directors and CIO's in each of the municipalities. This project as almost all the others mentioned, aims at development of the region by creating conditions for enterprises' and citizens' access to the information society and its new ways for communication. Cooperation is to take place whenever there are benefits in economy and/or in the business processes, but it is up to the individual municipality to engage itself in each new project that comes up.

4.8 Thesis project 2001

Many enterprises are connected to Traman but few of them uses it for other purposes than sending e-mail and surfing the Internet. To accelerate the process this projects aim is to look into what options there are for enterprises in Tranås to their own business development supported by new technology. Ten case studies were performed by students at JIBS, each studying the conditions for e-business in each of ten enterprises. Other groups have also supported with input during the process, eg business law students from Linköping University. Their task was to come up with proactive seminars and risk analyses in connection to e-business transactions. The project management has scanned news media on a day-to-day basis for relevant material, nationally and internationally. As one of the enterprises state, "our traditional enterprises undergo great changes and will work in a more efficient way thanks to IT."

ANALYSIS

In this section we start the analysis of the empirical data generated based on the interviews. The interviews focused on conditions for business development, where IT was one of the conditions.

4.9   Need for infrastructure

Need in this paper refers to the answers given by interviewees as items missing or problems, and expressed needs. The area to understand more about is what need of IT infrastructure SMEs have for enhancing growth, with special focus on communication and interaction. In the interviews, the Internet is regarded as more of an option than a threat. It serves as a complement for active customers who are using the Internet to inform themselves about the product, e.g. characteristics, price level etc, but do still need the physical visit for guidance. Quite a lot of the articles are complex and the need of information is great both among sales persons and customers. When the net shops compete with the price however, the net can turn to become a threat. The enterprises in Tranås must meet this with knowledge, competence, and service around the products they offer for sale. It is important for their customers, which often are SMEs to have a reliable service organization to turn to in the event of problems in order to avoid standstill. Especially among smaller enterprises there is a need for local suppliers for service and support which is an important role for smaller suppliers. Service and support concerns technical matters as well as use of applications and its integration with work processes in order to develop the enterprise. This need is not covered by net operating suppliers and these services play an important role in the customers' investments in IT and that they will work and be used in the further development of the enterprise. In cases of service and support, suppliers often make problem analyses and measurements via the Internet or by telephone calls and also most software problems are adjusted via the Internet together with support via telephone. Hardware problems have to be attended to on site. In turn suppliers (e.g. HP, MS) have support service for the local support suppliers who have the direct contact with the customer/end user. This is done almost exclusively via the Internet. In order to be able to perform a service efficiently, access to the Internet is demanded independent of if you operate from home/office or on the customer site.

A new pattern for distribution of information, services, and competence is observed by the interviewees. The web and the Internet have become increasingly important and the customer has to attend to the suppliers' site, has to be active in contacting and looking for data, not the opposite as it used to be. The active part is nowadays the information seeking sub-supplier. There is re-allocation of responsibility both regarding search for information and also costs for travels to visit the supplier. This re-allocation is made possible by web services and the earlier visits from sales representatives are now substituted by web services. Regarding the fact that these services are open for every sub-supplier, disregarding size and volume of accesses – it is possible for a sub-supplier in a small market to have access to the same information as a large sub-supplier in a large market. In other words, this development is in favour of small sub-suppliers and small markets if they only have the option to access the services.

We realized that the need for infrastructure in the IT area, are different among small (e.g. less than 10 employees) and a bit larger enterprises (e.g. 10 – 50 employees) regarding resources to maintain and develop an IT infrastructure. The smaller enterprises have no corporate infrastructure of their own where the larger enterprises have more but still have need for infrastructure. In the interviews some conditions for use of IT infrastructure emerges where the need is central. From the interviews we see other important aspects emerge, beside technology, e.g. business models into which all elements are to be integrated. Business models may come from ideas given by actors in a corporate structure or business partners or colleagues. They come in many shapes as e.g. business objects, best practice, ERP systems, business sector practices.

4.10 Needs for infrastructure and strategies for coping with them

When analyzing the empirical data on how enterprises cope with need and plans, three strategies emerge: competence strategies, cooperation strategies, and service strategies.

Competence strategies

Access to competence can occur in several ways – e.g. ALMI Företagspartner[5] can support with consultants for strategic/tactical planning. Other ways to access competence are via partners and suppliers. An important source for competence is investing in education of employees in the enterprise with rather big sums, e.g. 10 to 15 days a year per technician which equals to about one month working time and impeded billing. All the interviewees point out critical conditions for growth as access to competence, developing own competence; information about important news, to be in the news current, to keep track of what is going on. Earlier findings show that all enterprises need a basic level of IT infrastructure capability to implement new ideas and systems (Broadbent and Weill 1997).

Coming to IT, the interviews point in the direction of more focus on net learning instead of courses, video conference system instead of telephone meetings and traveling. The need for system support is growing very fast at a certain size of an enterprise. One system after another will be added. All interviewed companies mentioned their need for support in business intelligence. Firstly to have access to important information in the IT systems, and secondly to have the ability to interpret the data and perform analyses which can be followed over time. Competence strategies are about means for interpretation and sensemaking of news as options for business development with IT.

Cooperation strategies

To cope with growth and development most enterprises develop different kinds of cooperative strategies. One example is to cooperate with colleagues or similar suppliers within a geographical area. Another is to merge with a larger cooperation, and still another is to cooperate with suppliers and customers in a "symbiotic" way, more like a social network where enterprises help each other in many ways – e.g. ideas, technology, competence, employees, and capital. Cooperation with resellers is important and will increase in importance. In this situation the web is both a threat and an option. Almost all communication with suppliers is via the Internet and communication with customers is via the Internet as well as direct personal contact (but there are differences among the interviewed enterprises).

A transfer of responsibilities is observed by the interviewees (resellers) in contacts with suppliers. The customer is the active and responsible part, for making contacts and inquiries. The main supplier rarely visits the customer any more (sub supplier or reseller). Personal contacts occur at fairs and exhibitions. The new communication patterns concerning information, services, and competence – via the web are completed with local meetings where those interested take part. The active part is the information seeking sub-supplier with a re-allocation of responsibilities concerning to seek information and the costs for this (e.g. travel costs). This re-allocation is enhanced by web-services, where earlier visits from sales representatives are substituted by web-services. Having in mind that these services can be open to anyone, as

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[5] The basis of ALMI's mission is the need for financing and business development complementary to the market, where ALMI is the channel for investment based on an industrial policy that promotes economic growth
http://www.almi.se/almi_in_english.html

there is no extra cost to offer them to a small sub-supplier in a small market in comparison with a large market, one can say that this development favours small suppliers and small markets, if they only have resources to take part of the service. Communication can occur over large distances without problems. To have access to the services and support of a chain or a franchise is of vital importance, as a kind of infrastructure to exist at all, to expand, grow and develop, to be able to grow and consolidate in cooperation. Another way of putting it is that the option to rely on "a big sister" is crucial. Cooperation strategies are about giving and obtaining ideas and experience from the context for use and business development of IT, relating to sensegiving.

Service strategies
Services and support are central in the growth of the interviewed enterprises – to grow and as a product. "Our chance is to have a working service- and support organization to the products we sell". Service is identified as an important tool in the competition, and in this our 'cause for life' lies. Compared with the change in shopping patterns where the customer gets informed via the Internet (web services) before making the final decision in the shop. The Internet together with the competence of the sales person is the service in shopping, so to speak. This goes for all interviewed enterprises, in more or less direct ways. In this regard the service part of sales work or the products value increases. E.g. you cannot sell a heating pump without a rather substantial chain of information. All interviewed enterprises invest in this, in different ways. Services are about support in use and business development with IT.

4.11 Strategies related to needs for infrastructure
In coping with the need for infrastructure we have identified three strategies – competence, cooperation, and service. We find it interesting to see what needs that correspond to what strategy to get a rough indication the same way as above. In order to satisfy these needs enterprises develop strategies for cooperation and communication, in order to create business benefits. The strategies concern areas like communication, monitoring, learning, support, and business intelligence and where there are IT tools to support. The leading star for enterprises to develop strategies is business value, together with organizational readiness and external pressure. Need for infrastructure touch on different contexts such as local, firm wide, and public infrastructure. In the daily operation the two first mentioned contexts are important as facilitators. Actors in these two contexts are important as they are more easily communicated with, in comparison to actors in public infrastructure. You can communicate and express wishes for change and have an expectation on having an impact, with the constructor of a local or firm wide function more easily than the same situation concerning a function in e.g. MS Excel. The table beside combine needs for infrastructure with sensemaking, sensegiving and service, together with strategy, actors, and enterprise size.

Table 2 Needs, Strategy, Actors and Company size in terms of sensemaking, sensegiving and service

	Need	Strategy	Actors	Enterprise size
Sensemaking	Understanding changing conditions for enterprise development	Interaction and collaboration	Managers, planners, creators	Different conditions for sensemaking in enterprises
Sensegiving	Exposing and	Create interactive	Executives and	Also different

	Need	Strategy	Actors	Enterprise size
	interacting own ideas for feed-back	and collaborative climate and cul-ture	managers, infor-mal opinion lead-ers, external opi-nion leaders,	needs for sense-giving
Service	Service is a need to compensate for lack of compe-tence and other infrastructural resources	Service is a strat-egy for compet-ing on a local market as a local supplier	Local and not-local (both na-tional and inter-national) suppli-ers	Different needs according to size and corporate infrastructure (outsourcing strategy)

5 FORMATIVE INFRASTRUCTURE FOR ADOPTION AND USE OF IT

The main actors, important for development and growth, identified and studied in the empiri-cal data are suppliers, customers, resellers, partners, corporate management, employees, IT, and the municipality organization. All interviewees mentioned cooperation with other compa-nies in Tranås, as significant. If they can choose a local partner, they do. This can be unders-tood as they are interested in developing both their enterprise and their municipality. At the same time they say, that it is of crucial importance for surviving and development to be a part of a larger company or chain. 'Without it we would not exist'. It is also interesting that no one mentions TRAMAN as an important actor for growth, but rather as a facilitator for the access to global net services.

When summing up what actors occur in what combinations of need and strategy there emerges one group of actors who are *business partners*, e.g. suppliers, resellers, customers, and partners in e.g. product development or implementation projects. In another group with *internal and general actors*, there are both internal e.g. employees and corporate manage-ment, and external e.g. the municipality and the society in general (regions and state), where also IT is an important actor in both groups. IT in this sense is not to be viewed as one single actor, but rather many. TRAMAN is one IT-actor, the Internet is another, and communication software is still another. So in this study the notion of IT as actor rather refers to a group of actors, in line with the notion of technological frames and interpretative flexibility (Bijker 1995, Orlikowski 2000, Weick et al. 2005).

Actors in infrastructure occur in three types of infrastructure – local, corporate (organization wide), public (Weil and Broadbent 1998). In the data we have illustrations of the three types. *Public infrastructure* – to cooperate with the municipality to arrange education of interest, to cooperate with universities for research, assessment and education. Other examples are coop-eration with organizations like Telecities, Smart Community. It is also about to cooperate with colleagues in the same or mostly the same business sector in a larger geographical area, or to cooperate with suppliers – all in order to get access to competence and thereby the pos-sibility to offer better service and support to customers. *Corporate infrastructure* – is e.g. what occurs when an enterprise merges with a larger enterprise that contains infrastructural elements of interest, to become a part of e.g. a chain for access to interesting infrastructural elements (mostly in shopping but also as production firms give different levels of status to resellers) is to be regarded as a kind of franchise as different conditions are to be met by the resellers. *Local infrastructure* is within an enterprise.

5.1   Infrastructure facilitating IT adoption and use

IT is important in coping with needs. However investments in IT is first of all viewed as a question of comparing benefits with costs, i.e. its business value, in all interviews. This means that all interviewees take a business view of investments in IT. This could also imply that there is little interest in IT ("why do we find so little about IT in the interviews?") but more in the business or economic benefits of technology, i.e. the beneficial consequences of IT investments. To continue this line of thought, there is an implication that competence is not about IT itself, but its business impacts – experience from failure and success. The interviewees perceived a demand for competence to achieve shorter lead times, slim lined stock, and increased rate of turnover. So competence has an important ingredient of means for interpretation and sensemaking, where cooperation contains ingredients of idea generation and sensegiving, and access to service is important as a product both to deliver and buy.

The users of IT act and use IT based on their interpretation and understanding. In order for change to occur there is a need for influencing these interpretations and there is a need for actors to interact in sensemaking and sensegiving. Our findings confirm earlier research in technology use (Hanseth et al. 2004, 2006, Orlikowski 2000) and reveals that technology use is a complex process and also a sensemaking process (Weick 1995). Technology use is a process where users make objects around them rationally accountable to themselves and to reach some order in their everyday working life. In the processes there are several actors influencing both in sensemaking and sensegiving directions. We argue that there are needs among SMEs in these processes and that actors come into the processes in different ways, as business actors, internal actors, or general actors as IT and the Internet. The SMEs in our study have needs for better working sensegiving-sensemaking cycles; they have needs for images and experience of working IT in different business processes. These cycles are important in IT adoption, and they occur in all kinds of enterprises, but there is a difference in resources for accomplishing these cycles. From this it comes that one important property, when describing SMEs, is size, but also three other properties are important – independence, limited resources and lack of competence. The studied SMEs show examples of these sensemaking-sensegiving cycles, double interacts (Weick 1979), in that they consider it very important to be members and parts of all kinds of networks, e.g. Rotary, industry networks, friends, sporting friends and more.

So returning to the question of what is formative infrastructure, using the three kinds of infrastructure; local, corporate, and public infrastructures. From the SME view as compared to larger enterprises, there is less of infrastructure and less of overhead services and these are to be found outside the SME. Corporate infrastructure is smaller in SMEs, and there are more or less only two kinds of infrastructure for SMEs – local and public, and that SMEs to a larger extent are referred to and depend on, public infrastructure.

The adoption processes in SMEs differ from the ones in larger enterprises. The IT artefacts are elements in the formative infrastructure that shapes the routine behaviour of actors in enterprises. IT adoption is the process where the formative infrastructure is maintained as well as changed by actors enacting this context. The important thing here is that this is a process, a formative context is constantly moving, and is to be viewed as sensemaking-sensegiving cycles, as double interacts. This implies that SMEs are different from larger enterprises – SMEs rely more on external relations in a public infrastructure. Larger enterprises have these needs covered by its firm wide infrastructure.

Table 3 Needs, Strategy, Actors and Company size in terms of kinds of infrastructure

	Local infrastructure Microperspective	Corporate infrastructure Meso perspective	Public Infrastructure Macro perspective
Need	Operational needs	Coordination needs	Society development
Strategy	Collaboration and interaction with customers and suppliers	Collaboration within and coordination of supply chains	Conditions and infrastructure
Actors	Champions and managers, Informal opinion leaders	Corporate managers	Municipality institutionns, Eg TUC, TU, Tranås municipality
Company size	Small enterprises lack corporate infrastructure	Corporations can mix corporate infrastructure to complete public infrastructure	Different demands for infrastructure depending on enterprise structure/demography

We have identified a number of implications for a formative infrastructure in adoption and integration of IT with business processes. Conditions for the integration are to be found in the formative infrastructure, to a large extent in terms of knowledge, competence and interpretative frames. IT adoption involves identity construction, and negotiations around sorting relevant meanings from irrelevant to reach a shared understanding. The process of formatting infrastructure and being formatted by it could be expressed as *formative infrastructuration*, to mark its ongoing character. Into this process comes what is mentioned earlier as knowledge for use of IT, triggers for sensemaking, and double interacts. For SMEs it is in these respects that there is a difference compared to larger enterprises.

5.2   What actors take part in development of IT infrastructure? Where are the actors located? Inside the enterprise? In the local municipality?

This study identifies actors and arenas that do not easily fit into the three categories of local, firm wide and public infrastructures, and the empirical data indicates a need for extension and adjustment. We have identified some important actors that can be sorted into three more general groups: (1) local actors, (local management, employees), (2) firm wide actors (corporate management, franchise givers) and (3) public actors (suppliers, customers, resellers, partners, municipality). It is not evident that interaction among customers and suppliers occur in one business sector, but possibly across several business sectors with e.g. suppliers in one business sector and customers in another. Also in the case of sensegiving, enterprises from different business sectors interact. From the perspective of a firm, as in firm wide infrastructure, there are important relations with customers and suppliers (cf. in a network), but with a cooperative strategy, as in many of the firms in this study, also relations with e.g. suppliers or with customers play a role for interpreting and making sense of IT. The analysis of the empirical data shows a need for arenas where relations and activities are other than the traditional customer-supplier-relation, at an infrastructure of arenas for interaction and collaboration among actors from several business sectors and corporations - an infrastructure for collaboration.

In all three categories of infrastructure (1, 2, and 3 above), actors are implicit, which also goes for the interaction. The empirical data indicates a need for developing a concept of formative IT infrastructure where actors and interaction are more visible (explicit), and thus making it a

verb, *infrastructuration,* more than a noun, infrastructure. As stated by Hanseth and Lyytinen (2004), information infrastructures do not develop due to planned and controlled actions by some developers, but rather in a process imbued with surprises, blockages, diversions, side effects and vicious circles, as well as inherent tensions between the need for universal standards and locally situated practices. The same conditions are relevant to formative IT infrastructures.

5.3   A formative infrastructure for enterprises in IT adoption and use

A *formative IT infrastructure* is constituted by the identified needs among SMEs in our study, and it contains three parts; (1) sensemaking, (2) sensegiving, and (3) service infrastructures. Sensemaking infrastructure (1) is about conditions for making sense of IT, to give the ability to realize what IT can be used for in business development, to make sense of IT in a business development perspective. Sensegiving infrastructure (2) is about imposing meaning to others about what IT can be used for in business development. Sensegiving is about realizing the business value of new IS-functions or existing IS-functions used in new ways, or for that matter the lack of business value in some IS-functions. Service infrastructure (3) is about having the installed base work as intended and the importance of services and functions in a corporate infrastructure, and also that the lack of it has to be handled by those (SMEs) that do not have access to that kind of services within their own business. So what we see is that formative IT infrastructure refers to the situation where enterprises deal with IT when developing their enterprises and also to what actors, strategies, and IT-areas to invest in. It is still an open question what roles actors have within public and local infrastructures in this respect.

In the case of formative IT infrastructure there is a special focus on the knowledgeable use of IS, and there is an element of know-how/competence which plays a role for setting relevant expectations on IS-use or IS-investments. The analysis of empirical data of this study indicates that the perceived business value was the most important explanation to decisions, when it comes to investments in IT. The weak interest for the technology of IT among SMEs has two reasons. One is too little knowledge of the business benefits of IT. Another one is that there is knowledge and that knowledge point at investments in IT to have limited or weak influence on business benefits, and therefore is less interesting. More in general, formative IT infrastructure takes into account the conditions for using the hard IT infrastructure, the means for knowledgeable use of IT, e.g. resources for communication, analyzing and acting on market signals, learning, offering or ordering service.

5.4   Bringing the concept of formative infrastructure micro- and macroperspectives

The adoption processes differ between different microsystems and as in the realist review (Pawson et al 2004) one asks what is the mechanism that makes interventions work or not in specific contexts. Formative infrastructure gives some guidance to what conditions are important for adoption to occur, and further develops the concept of context. The information systems are elements in the formative infrastructure that shapes the routine behaviour of actors (cf. Orlikowski 2000) in microsystems. Adoption is the process where the formative infrastructure is maintained as well as changed by actors enacting this context. So what makes things change in a microsystem? In this paper the argument is that it is the process of establishing or re-establishing local theories and norms in the microsystem. The important aspect here is that this is a process, a formative context is constantly moving, and is to be viewed as sensemaking-sensegiving cycles, as double interacts (Weick 1995, 1979). This implies that

there is a difference between microsystems – there are those with a supportive formative infrastructure and those with a less supportive formative infrastructure. In separating different outcome areas as individual, organization and patient [!], a more comprehensive background and understanding of the process of education and its impact is provided.

We have identified a set of implications for a formative infrastructure in adoption and integration of IT with work processes. Conditions for the integration are to be found in the formative infrastructure, to a large extent in terms of knowledge, competence and interpretative frames. Adoption involves identity construction, and negotiations around sorting relevant meanings from irrelevant to reach a shared understanding. The process of formatting infrastructure and being formatted by it could be expressed as formative infrastructuration (referring to Giddens theory of structuration (Giddens 1984)), to mark its ongoing character. Into this process comes knowledge for use of IT, triggers for sensemaking, and double interacts. It is in these respects that there is a difference regarding the formative infrastructure among microsystems. The concept of formative infrastructure adds a more comprehensive understanding of the impact of education (enbart education?), or the conditions for education to have an impact.

Looking back, there has been a focus on large organizations (e.g. Weill and Broadbent 1998, Ciborra et al. 2000) but not on SMEs. Previous studies show that enterprise size and IT-competence are important in the exploitation of IT-infrastructure, e.g. e-services and municipality broadband (Nutek 2004). In SMEs, there is a strong connection between IT-use and how much cooperation there is with other enterprises. Users that are accustomed to new technology quickly see a lot of applications and management in SMEs often develop external relations to deploy different kinds of technology knowledge and competence, but also to legitimize technology change and mobilize motivation to renewal. External relations concern foremost customers and suppliers, where demanding customers are known to have an impact on product and technology development, e.g. in the case of EDI (electronic data interchange), a standard of exchanging messages more or less imposed on suppliers and subcontractors by large and influential customers. Also relations with colleagues in the same business, local networks of knowledge and consultants are important. In the conversation with colleagues and experts you come to realize options and possibilities in technology. Common parts of IT infrastructure are traditionally described in different contexts – public, industry, corporate, local (Weill and Broadbent 1998, Ciborra et al. 2000, Hanseth and Lyytinen 2004). From the SME perspective the elements may differ, where the corporate part may be missing or the same as the local.

5.5 Elements in a formative infrastructure

Theoretically we contribute to the development of the concept of IT infrastructure and add to it formative IT infrastructure. This is an important contribution. In dividing IT infrastructure into two major areas – hard and formative infrastructure, the results indicates that, both are important, but formative IT infrastructure in SMEs is a less known and elaborated concept. When analyzing the need for formative IT infrastructure, three types, emerge – sensemaking infrastructure, sensegiving infrastructure, and service infrastructure, as three cornerstones of a formative IT-infrastructure:

Sensemaking infrastructure corresponds to need for:

- Competence in many ways - for use of IT applications, for analyzing the enterprise (or parts of interest), planning and monitoring, for hiring employees with new ideas, access to expert knowledge from consultants, access to expert knowledge from suppliers.
- Analysis - somewhere between communication and planning/monitoring is analysis, as e.g. analysis of communicated interest in groups of products, where input comes from communication and output is given to planning and monitoring.
- Mostly within corporate and business sector infrastructure.

Sensegiving infrastructure corresponds to need for:

- Tools for planning and monitoring – ERP systems, new combinations of business processes and IT, ideas for extracting large amount of data to intelligible information.
- Occurs within all three parts of formative infrastructure.
- Triggers for sensemaking.

Service infrastructure corresponds to need for:

- Service and support – both as a need and as a product to compete with.
- Tools for communication and supporting systems and tools – the Internet, web services, system integration – both with internal systems as well as external ones.
- For larger enterprises some or most is found within the firm wide infrastructure.
- For SMEs these are public actors that are important to have access to.

In this study a central point has been the view of infrastructure as 'structures that are needed for the operation of a society or enterprise' (Star 2002), which is a description that opens up for thoughts on infrastructure from aspects like, technical, social, and communicative. Information infrastructures (Hanseth and Lyytinen 2004) are often understood as networks where a broad range of human and non-human actors influence the development of networks in a variety of ways. We have found that the interaction is about exchange of ideas, experiences, knowledge, and triggers sensemaking by giving input to evolution and business development. The concept of information infrastructure does not however take into account the social conditions concerning the interaction among actors to take place. Nor does it take into account the conditions in the context for IT use.

	Local infrastructure Microperspective	Organization (corporate) infrastructure Meso perspective	Public Infrastructure Macro perspective
Sensemaking	Adoption in the close social context	Climate and culture for adoption, resources and investments	Relevance of services (education, arenas, …) for enterprises needs
Sensegiving	Management and planning, informal discourse	Management and planning	Marketing, information, education
Service	Local market has a special importance as a complement to the global.	Support and assistance are some of the services in a corporate infrastructure	Conditions for service suppliers

Table 4 Infrastructure for sensemaking, sensegiving and service

By the three groups of formative infrastructure – sensemaking, sensegiving and service – these conditions can be understood in more detail and in relation to business needs of SMEs.

The notions of technologies-in-practice (Orlikowski 2000) point at conditions for use as interpretive, technological and institutional, and the context of their emergence is that of larger enterprises. In larger enterprises there are rich structures of rules and resources for technology-in-practice as firm wide infrastructure, but this is not the case in SMEs. For covering their needs, SMEs have to rely on public infrastructures.

6 CONCLUSIONS AND FURTHER RESEARCH

In this paper we have investigated IT infrastructure and the need for it. We have argued that hard IT infrastructure (the technological media that carries data) is not a sufficient condition for growth. There are other needs to be covered in order to get a more thorough understanding of conditions for growth. We identify elements in a formative IT infrastructure as a fruitful way to cover more relevant infrastructure and conditional aspects.

As seen in this paper, it is not a planned action to make infrastructure grow. Still there is a lot to learn about design processes of formative IT infrastructure. In regarding more elements of infrastructure, as in formative IT infrastructure, there is a better understanding of which components that are important and influential. One possible design task for e.g. a municipality management is that of facilitating the evolution of relevant networks for enabling sensemaking, sensegiving and service. One important first task in this endeavour is to promote networks. The task focus is on promotion and start, and then letting them evolve with little or no assistance. The main task is to identify the users being willing to adopt the technology first, then those willing to adopt to it as second, and so on. The identifying task then is crucial, identifying users willing to adopt IT or having already adopted it with interesting experiences for others to share.

A formative infrastructure has a focus on conditions for IT adoption and use, and is a development of formative context (Ciborra and Lanzara1994). The concept of a formative context that was generated with a focus on the study of individual enterprises and individual actors. In this paper focus is more on infrastructure and need for infrastructure as on the one hand a larger context for enterprises, and on the other hand formative context within enterprises as corporate and local infrastructure (Weill and Broadbent 1998), and the focus in the paper is on creating a framework for the concept of formative infrastructure. A part of the development of the concept of formative infrastructure is the separation of micro-, meso- and macro-perspectives based on needs for infrastructure and focusing on sensemaking, sensegiving and service-infrastructures.

The present piece of research takes an SME situation as a point of departure. Based on this one can claim that the results are unique for such setting of firms in the present region. However, using the SMEs as a point of departure we can highlight issues related to typical characteristics (e.g. flexibility, needs crossing organizational boundaries, lack of resources etc.) of such firms. In doing so we can add knowledge to the existing body of knowledge that to a large extent is based on empirical research at larger firms. We also compare our results with this body of knowledge in order to put it into a larger context. Larger firms can of course also have characteristics that are in some sense extreme for an SME, but we do not claim generalizability in a statistical sense.

The results presented in this paper represent a new combination of previous knowledge (theories and concepts) based on an empirical study and a literature review. We consider this a part of an cumulative knowledge base on formative infrastructuration.

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