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Formative Infrastructure for ICT-Adoption in SME's - A Case Study of Conditions for Progress

Klas Gare

Jönköping International Business School, klas.gare@jibs.hj.se

Carita Abom

Jönköping International Business School, carita.abom@jibs.hj.se

Ulf Melin

Linköping University, ulf.melin@liu.se

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FORMATIVE INFRASTRUCTURE FOR ICT-ADOPTION IN SMES - A STUDY OF CONDITIONS FOR PROGRESS

Gäre, Klas, Jönköping International Business School, PO Box 1026, SE-551 11, Jönköping, Sweden, klas.gare@jibs.hj.se

Åbom, Carita, Jönköping International Business School, PO Box 1026, SE-551 11, Jönköping, Sweden, carita.abom@jibs.hj.se

Melin, Ulf, IEI, Linköping University, 581 83 Linköping, Sweden, ulf.melin@liu.se

Abstract

The focus in this paper is on conditions for ICT use in SMEs expressed as formative infrastructure. Questions concern needs for infrastructure among SMEs, actors roles, and concepts constituting a formative infrastructure for ICT-adoption and use. Few – if any – studies, take the perspective of SMEs' needs for infrastructure concerning use of ICT. A formative ICT 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. ICT 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 ICT infrastructure into two major areas – hard and formative infrastructure, the results indicate that, both are important, but formative ICT infrastructure in SMEs is a less known and a less elaborated concept. When analyzing the need for formative ICT infrastructure, three types, emerge – sensemaking infrastructure, sensegiving infrastructure, and service infrastructure, as three cornerstones of a formative ICT-infrastructure.

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

1 INTRODUCTION AND PROBLEM AREA

This paper presents a study of the process of exploiting an information and communication technology (ICT¹) infrastructure in small and medium sized enterprises² (SMEs) in a Swedish municipality. Previous studies show that the use of ICT 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). ICT use requires a lot of resources as well as social interaction (Gal, Yoo and Boland 2005, Star 2002, Hanseth and Monteiro 1998). ICT use varies among enterprises to a large extent depending on size and ICT competence, where smaller enterprises have smaller resources in this respect (Persson 2000, Nutek 2004). The focus of this study is to investigate the conditions for ICT use among SMEs. Special focus is on adoption and use, as ICT must be used in order for development to occur. ICT adoption and use is where the individual makes sense of ICT 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 ICT when brought into working life, and the notion of technological frames refer to interpretative flexibility, that artefacts (e.g. ICT) 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 purposes and apply their understandings (Bijker 1995, Orlikowski 2000, Orlikowski and Gash 1994). A formative infrastructure then, is the infrastructure for ICT integration into work processes, or in more casual terms, the context for ICT-use. ICT use is a result of an adoption process, where sensegiving and sensemaking take place.

In the reviewed studies the dominant perspective is of implementation of ICT, no one takes the perspective of the users’ demands or needs – neither individual nor organizational. The perspective of this study, reported in this paper, is SMEs needs for infrastructure for ICT adoption and use.

The studied in this paper is SMEs in 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 TRAMAN³ 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 ICT-competence of their own; they rely on suppliers for services and support in order to serve their customers in turn.

The key question in this paper is: What is a formative infrastructure for SMEs in ICT adoption and use? Three sub questions are used in order to be able to answer the key question in the paper:

- What needs are there among SMEs for infrastructure facilitating ICT adoption and use?
- What actors take part in development of infrastructure? Where are the actors located? Inside the SME? In the local municipality?
- Can the concepts of sensemaking and sensegiving contribute to a better understanding of a formative infrastructure?

¹ICT, 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.

³ Tranås Metropolitan Area Network

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. The following section (three) is a brief description of the research method, which is followed by a description of empirical findings and first level analysis (section four). In section five, an analysis and a discussion are performed and lastly, in section six, is a concluding summary.

2 INFRASTRUCTURE FOR ICT ADOPTION AND USE

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 level of analysis, and a better understanding of change and variation at the macro level by investigating its influence on the behaviour of individual actors, and how these actions generate new macro states at a later time (Weick et al. 2005). The macro level corresponds to the concept of context or infrastructure for enterprises in this text, and microstructure to the individual enterprise. The area of interest is the dynamics of sensemaking and sensegiving in the context of ICT adoption and use among SMEs.

2.1 Adoption as series of sensemaking and sensegiving

Adoption does not take place as a single decision, but rather as series of sensemaking cycles (Seligman 2006). In these cycles 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 et al. 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 et al. 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 ICT adoption and use in SMEs.

2.2 Individual perspective on sensemaking (micro)

From the perspective of the individual, ICT-use is about figuring out how new ICT can be integrated in the actors’ specific organizational processes getting the new ICT 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 ICT adoption (Seligman 2006).

2.3 Organization and context perspective on sensemaking (macro)

From the perspective of organization, ICT-use is about the social context for ICT-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 ICT-use. What is not yet well known are the conditions for this communication and how it affects ICT 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 ICT-use 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 of ICT. In contexts where limited learning and invention occur, the organization is incapable of enquiring into the existing formative context (Henfridsson 2000). So one important condition in the formative context and for ICT to be meaningful and sensible in business processes, is the extent of learning and invention which occur in alignment of ICT adoption, norms and experiences of the organization. Making the most out of ICT adoption, an organization needs to trigger sensemaking processes around the technologies (ibid.).

2.4 The context of SMEs

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 ICT-competence are important in the exploitation of ICT-infrastructure, e.g. e-services and municipality broadband (Nutek 2004). In SMEs, there is a strong connection between ICT-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 ICT infrastructure are traditionally described in different contexts – public, industry, corporate, local (Weill et al. 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.

3 RESEARCH METHODOLOGY

The methodological point of departure and approach in this study is qualitative and interpretive in line with the explorative 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 ICT and infrastructure is that reality is a social construction by a human actor, and that there is no objective reality to observe (Berger and Luckmann 1967, Walsham 1993). Interpretivism can be seen as an epistemological position concerned with understanding reality and a position that all 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 ICT and the SME context and the principle of multiple interpretations (of e.g. ICT). In our study we rely heavily on qualitative interviews as a source to generate empirical data.

The study consists of interviews with 9 enterprises during 2000 and 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 ICT 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 ICT-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. ICT, 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 ICT infrastructure. The theories about sensemaking, sensegiving, and social infrastructure have been a guide in sensitizing concepts and interpreting processes (Klein et al. 1999). 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 et al. 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).

4 THE STUDY - FIRST LEVEL ANALYSIS

In this section we describe and summarize answers given by the interviewed persons. In the interviews a focus was on conditions for business development, where ICT was one of the conditions.

4.1 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 ICT 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 ICT 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 ICT 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 ICT 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 ICT 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.

4.2 Strategies for coping with need for infrastructure

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 Företagspartner⁴ 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 ICT infrastructure capability to implement new ideas and systems (Broadbent and Weill 1997).

Coming to ICT, 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 ICT 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 ICT.

⁴ 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

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 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 ICT, 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 ICT.

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 ICT 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.

4.3 Actors in infrastructure

The main actors in the context of SMEs, important for development and growth, identified and studied in the empirical data are suppliers, customers, resellers, partners, corporate management, employees, ICT, and the municipality organization. All interviewees mentioned cooperation with other companies in Tranås, as significant. If they can choose a local partner, they do. This can be understood 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 for SMEs.

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 management, and external e.g. the municipality and the society in general (regions and state), where also ICT is an important actor in both groups. ICT in this sense is not to be viewed as one single actor, but rather many. TRAMAN is one ICT-actor, the Internet is another, and communication software is still another. So in this study the notion of ICT 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, firm wide, public (Weil et al. 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 cooperation 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 possibility to offer better service and support to customers. *Firm wide infrastructure* – is e.g. what occurs when a SME 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 SME.

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).

5 ANALYSIS AND DISCUSSION

In this paper we have investigated ICT infrastructure and the need for it among SMEs. We have argued that hard ICT 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 among SMEs. We identify elements in a formative ICT infrastructure as a fruitful way to cover more relevant infrastructure and conditional aspects.

5.1 What is a formative infrastructure for SMEs in ICT adoption and use?

A *formative ICT 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 ICT, to give the ability to realize what ICT can be used for in business development, to make sense of ICT in a business development perspective. Sensegiving infrastructure (2) is about imposing meaning to others about what ICT 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 ICT infrastructure refers to the situation where enterprises deal with ICT when developing their enterprises and also to what actors, strategies, and ICT-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 ICT 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 ICT. The weak interest for the technology of ICT among SMEs has two reasons. One is too little knowledge of the business benefits of ICT. Another one is that there is knowledge and that knowledge point at investments in ICT to have limited or weak influence on business benefits, and therefore is less interesting. More in general, formative ICT infrastructure takes into account the conditions for using the hard ICT infrastructure, the means for knowledgeable use of ICT, e.g. resources for communication, analyzing and acting on market signals, learning, offering or ordering service.

5.2 What needs are there among SMEs of ICT infrastructure facilitating ICT adoption and use?

ICT is important in coping with needs. However investments in ICT 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 ICT. This could also imply that there is little interest in ICT (“why do we find so little about ICT in the interviews?”) but more in the business or economic benefits of technology, i.e. the beneficial consequences of ICT investments. To continue this line of thought, there is an implication that competence is not about ICT 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 ICT act and use ICT 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 sense-making 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 ICT 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 ICT in different business processes. These cycles are important in ICT 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 for SMEs, using the three kinds of infrastructure; local, firm wide, 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. Firm wide infrastructure is smaller in SMEs, and there more or less are 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 ICT artefacts are elements in the formative infrastructure that shapes the routine behaviour of actors in enterprises. ICT 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.

We have identified a number of implications for a formative infrastructure in adoption and integration of ICT 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. ICT 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 infrastructuring*, to mark its ongoing character. Into this process comes what is mentioned earlier as knowledge for use of ICT, triggers for sensemaking, and double interacts. For SMEs it is in these respects that there is a difference compared to larger enterprises.

5.3 What actors take part in development of ICT infrastructure? Where are the actors located? Inside the SME? 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. 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 ICT. 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 ICT 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 et al. (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 ICT infrastructures.

5.4 Can the concepts of sensemaking and sensegiving contribute to a better understanding of a formative infrastructure?

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

Sensemaking infrastructure corresponds to need for:

- Competence in many ways - for use of ICT 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 ICT, 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 et al. 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 ICT use. 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 CONCLUDING SUMMARY

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 ICT infrastructure. In regarding more elements of infrastructure, as in formative ICT 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 ICT or having already adopted it with interesting experiences for others to share.

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