Towards holistic management of information within service networks: Safety telephone services for ageing people

Helinä Melkas

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Abstract

The dissertation investigates information quality in multi-actor service networks. A clear connection between the quality of information and success of business has been acknowledged, but tools for analysing information quality in network environments on the basis of qualitative data have been lacking. There is also a limited understanding of information processes of virtual networks of public and private service organizations in the literature.

In this dissertation, a novel framework for information quality analysis is developed and operationalized. It extends previously developed methods and provides a fundamentally different way to assess information quality, contrary to earlier quantitative studies. In addition to investigating and developing management of information quality, the dissertation focuses on collaboration and networking within the heterogeneous multi-actor service networks.

Operationalization of the newly developed framework for information quality analysis is undertaken in the virtual network environment of safety telephone services for ageing people. These services utilize rapidly developing well-being technology. The analysis is based on data from interviews with professionals working in several service networks of different types and sizes.

The results provide a detailed account of the state of information quality and network collaboration in the case networks. The results can be utilized as guidelines when planning information-related matters in the case networks in the future. Practical recommendations for the branch of safety telephone services are formulated. The dissertation also contains a thorough assessment of the usability of the framework of analysis. Suggestions concerning future use of the framework are formulated. The dissertation thus contributes to development of new tools for analysing information quality. It also suggests directions for future research.

Keywords:
Information quality, information management, service network, safety telephone services

Foreword

This dissertation has been written within the framework of two larger research programmes of Helsinki University of Technology Lahti Center: "Information transfer and management in business networks" and "Safety and communication services in the environment of ageing people".

Participation in these programmes clearly showed the need to incorporate information quality thinking into the operations of safety telephone service networks – new kinds of virtual multi-actor networks. This branch then provided a worthwhile environment for the operationalization of a framework for information quality analysis. The framework that has been developed during this research process is anchored in previous studies on information quality. Despite a wide recognition of the importance of considering information quality in business processes, it has been studied surprisingly little with a qualitative approach.

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1 Introduction

1.1 Background

Studies of organizations usually mention information transfer as one of the key problem areas. If they do not, there is likely to be something wrong in the methodology or conclusions. Information transfer and management are areas characterized by many – and often conflicting – demands. Employees require more information and fast, but on the other hand, they are struggling with the wealth of information that is too large to digest.

A crucial issue concerning information transfer and management is the quality of information that is collected, stored and transferred. It has been stated that there is a clear connection between the quality of information and success of business. Poor information quality costs billions in social and economic impact (cf. Strong, Lee and Wang, 1997a). Still, very few companies have started to improve the quality of information in a systematic manner. Poor quality information is typically inaccurate, overlapping or insufficiently defined. Mapping and management of information quality need to be continuous processes. (English, 1999.)

Discussions on information mostly concern information systems, information technology, data warehouses and data mining, to mention a few examples. The most relevant issue is, however, the information itself – the material that is essentially needed. Successful companies excel by exploiting information. They must define, measure, analyse and improve the quality of information (Huang, Lee and Wang, 1999).

The real goal of information quality is to increase customer and stakeholder satisfaction – better information quality leads to better customer service (English, 1999; Huang, Lee and Wang, 1999). If internal users of information within organizations are treated as consumers of information, their performance and productivity will improve. Delivering quality information may be seen as a self-reinforcing process leading to improved company performance. (Huang, Lee and Wang, 1999.)

Tools have been developed for measuring and analysing information quality (e.g., Huang, Lee and Wang, 1999; English, 1999; Wang and

Strong, 1996; Paradice and Fuerst, 1991; Wang, 1998; English, 1996; Wang, Lee, Pipino and Strong, 1998; English, 2001; Dvir and Evans, 1996; Allen, 1996; Strong, Lee and Wang, 1997a; 1997b; Lee, Strong, Kahn and Wang, 2002; Kahn, Strong and Wang, 2002). These have mainly been utilized in individual organizations, often companies. Information transfer processes and management of information quality are challenging enough within one organization with clearly defined boundaries. Yet, we are witnessing a rapid increase in networking and virtualization among companies. These translate into further challenges in all areas of operations, but information-related issues require particularly urgent attention.

Networking and virtualization do not concern companies only. Public organizations, cooperatives and non-governmental organizations are also forming networks, or entering into networks of companies. This tendency is clearly seen, for instance, in the social and health care sector of the society, and in the utilization of new kinds of well-being technology. Challenges appear to be especially numerous there.

The present dissertation will investigate information quality in multi-actor networks that provide services based on the use of well-being technology. Tools for analysing information quality in such environments are lacking. In this dissertation, a new kind of framework for information quality analysis will be introduced and operationalized. It will extend previously developed methods and provide a fundamentally different way to assess information quality on the basis of qualitative data – contrary to the earlier quantitative studies.

1.2   Research problem and questions

The research topic of the present dissertation is information transfer and quality as well as networking and collaboration principles and practices of organizational service networks. Viitanen (1998: 94) has noted concerning network organizations that an individual network organization is an expert in networking, lives from and because of it, and its life span is largely determined by the network's success and evolution. "Its prime interest is in establishing and taking care of the network itself – as its core business through reciprocal cooperative arrangements with other autonomous organizations".

The research problem of this dissertation is the need to investigate and develop, on the one hand, management of information quality and, on the other hand, collaboration and networking within heterogeneous multi-actor service networks. These have rarely been studied. Particularly the combination of these two points of view is novel. The dissertation will widen the sphere of qualitative methods of analysis. It will also indicate intriguing possibilities for further development and operationalization of the methodology to be introduced.

The research questions of this dissertation are related to (i) quality and content of information, (ii) management of information quality and (iii) management and functioning of network collaboration to support information quality. The research questions are as follows:

- What are the courses and bottlenecks of information flows in the networks? What kind of information is being transferred?
- What is the quality of information being collected, stored and transferred? How can this be analysed in a systematic way in the networks?
- How does network collaboration in the networks affect information quality – and vice versa?

Enterprise networks and information management systems are widely studied fields – and the focus of considerable attention also within the business community – but there is a very limited understanding of the information processes of networks of public and private service organizations in the literature. Virtual organizations, virtual enterprises and virtual teams within enterprises have been studied by many researchers in the last few years (e.g., Rouse, 1999; Voss, 1996; Kotorov, 2001; Jarvenpaa, Knoll and Leidner, 1998; Jarvenpaa and Leidner, 1999; Putnam, 2001; van Hout and Bekkers, 2000; van der Smagt, 2000; Katzy and Dissel, 2001; Kayworth and Leidner, 2002; Miles and Snow, 1992; Duarte and Tennant Snyder, 2001; Handy, 1995; Holton, 2001; Lipnack and Stamps, 1997; DeSanctis and Monge, 1999).

The kinds of multi-actor service networks that are studied in the present dissertation have, however, barely been investigated. Some work has been done to assess effectiveness of public-sector service networks (cf. Provan and Milward, 2001), but information-related matters were not included among the effectiveness criteria. Very little work has been devoted to the particular requirements placed by the utilization of well-being technology on information processes, information quality and

networking among different types of organizations – despite the growing societal weight of such technology. The scarcity of reference literature may be due, in part, to the rapid development of the field in question.

In line with increasing networking among organizations, many new opportunities are created – but severe problems may also arise. Improving and redesigning information flows within a network is difficult, because, for instance, the precise course of information flows may not be known and information about factors affecting them may not be readily available. Problems may also be caused by differences in control systems of the network participants, or lack of such systems. The quality and content of the information itself may be very insufficient. The human factor that is very relevant in all communications may also be inadequately taken into account.

Traditionally, information flows have been a background factor in studies on operations of company networks, but in the present dissertation, the situation is vice versa. Information flows, particularly information quality and content shed light on the operations of the networks. The state of the networks' collaboration relations, functionality of information systems, command and relaying of customer and other information as well as speed in service provision and ability to react on changes in the external environment are crystallized in information flows.

1.3   Objectives of the dissertation

The objective of this dissertation is as follows: to develop a framework of analysis for investigating information quality within information processes of organizational networks on the basis of qualitative interview data – in order to contribute to development of tools for information quality management and analysis – and to operationalize this framework of analysis within networks providing safety telephone services to ageing people.

As a corollary of this objective, this dissertation aims to produce recommendations for practical development work in the case networks in question with regard to (i) information quality and (ii) related general network collaboration.

The quality of information cannot be improved independently of the processes that produced this information and of the contexts in which

information consumers utilize it (Strong, Lee and Wang, 1997a). A starting point in the present dissertation is that the same applies vice versa. That is, contexts and processes of networks cannot be improved independently of the quality of information. Quality information is essential also because through the assessment of information, knowledge controls and guides decision-making and other processes in organizations (cf. Huang, Lee and Wang, 1999; English, 1999; Miller, Malloy, Masek and Wild, 2001).

The research questions and objective of the present dissertation are solidly anchored on existing literature, but the approach is novel in that it will result in a new type of qualitative methodology and its operationalization in emerging forms of organizational environments. The dissertation will also approach the issue of information quality from a wider perspective than earlier studies to capture its organizational contexts. The scope and contents of the review of existing knowledge relating to the research topic will illustrate this intention.

1.4   Scope of the dissertation

The present dissertation is about information and information quality as well as their management in networks. Methodology development is especially central. The restrictions and emphases concerning the scope of the dissertation are mainly related to that fact.

The amount of alarm and technical information received and transferred in call centres will be treated here as background information only. The challenges in this field may largely be solved with improvements in the technical arrangements of the call centres. The dissertation does not contain an investigation of information systems as such, either. Firstly, the focus is on content and quality of information, and secondly, within the case networks, such an approach would not be meaningful.

Well-being technology – safety telephone services is the field of case studies only. The whole of safety telephone services, not to mention the whole of well-being technology, cannot be discussed. Different types of safety telephone appliances and optional calling systems and their usability, for instance, will thus not be described.

The dissertation touches upon issues such as (i) customers' – ageing people's – opinions and requirements concerning safety telephone

services and appliances, (ii) operations and work arrangements at call centres, (iii) service chains of customers as well as (iv) competence requirements of personnel working in these services. It would not make sense to totally exclude them in this type of an investigation, but a comprehensive analysis is beyond the scope of the dissertation.

The emphasis in studying information flows is in the networks' operations outside of the call centres that receive calls from customers. This emphasis is necessary, because the dissertation is about networks, and the networks are large and extend also to the municipal social and health care sector.

The history of safety telephone services and legislation behind these services will not be discussed either. A description of those may be found in, for instance, the work of Lehto and Vuoksenranta (1999). A review of social protection for the elderly in Finland is also beyond the scope of this dissertation (see, for example, Vaarama and Kautto, 1999).

Justifications for certain additional restrictions and emphases will be included in their relevant places in the text, when they concern a particular detail. Their meaning is considered to be clarified in this way.

1.5   Research approaches and methods

The present dissertation is based on (i) methodology development and (ii) operationalization of the methodology with the help of case studies. The methods to be applied are overwhelmingly qualitative, but certain quantification will also be used. The data to be produced by applying qualitative methods will be analysed with the help of an information quality framework. The dissertation will introduce a new kind of framework of analysis for investigating information quality within the information processes of safety telephone services. The framework is applicable also in other fields.

The dissertation will present the way in which the information quality analysis itself is undertaken, step-by-step, and specify its results. Through this, insights will be offered into practices and challenges of information quality management. Thereafter, networking and collaboration in networks will be investigated more generally to find out about factors affecting information quality and to utilize the rich qualitative data to the fullest possible extent.

The dissertation follows both an ideographic and a nomothetic approach (Evered and Louis, 1981; Dooley, 1995). It investigates the particulars of individual research objects, the case networks. In accordance with the nomothetic approach, it aims at developing empirically valid, general laws for use in varying settings of the real world. There are also characteristics of a decision-making methodology approach in the dissertation, however. This approach results in developing and applying problem-solving methods, and the empirical part of the study mainly provides an application example. (Cf. Kauranen, Aaltonen, Naumanen and Kaila, 1992.) Information quality analysis may be seen as a problem-solving method – either as an end in itself or one element in general quality assessments.

Despite the scarcity of relevant literature and studies on the topic of the present dissertation, it is argued that the time is ripe for the nomothetic approach – in the form of the qualitative methodology to be proposed for investigating information quality. Moreover, despite the heterogeneity of the safety telephone service systems in Finland, it is argued that this branch provides a particularly suitable and interesting environment for the operationalization of the new methodology.

Several interesting and relevant research sites were found for the dissertation. The sites are representative of the different types of safety telephone service networks. The investigation is done in local, regional and nation-wide networks of companies, public organizations and other organizations that offer safety telephone services in collaboration. Public organizations include various municipal social and health care institutions. Companies include call centre companies, care service providers, telephone operators and alike. Other organizations are non-governmental organizations, foundations and cooperatives.

Particularly the large case networks are good examples of newly emerging virtual networks based on loose cooperation arrangements between organizations in different geographic locations (see Figure 1). These networks are also good examples of structures, where the core organization has combined other organizations' resources to its core capability and created sustainable working relations. The smaller networks, again, contain many different types from municipal networks to pilot projects testing newest technology of the branch.
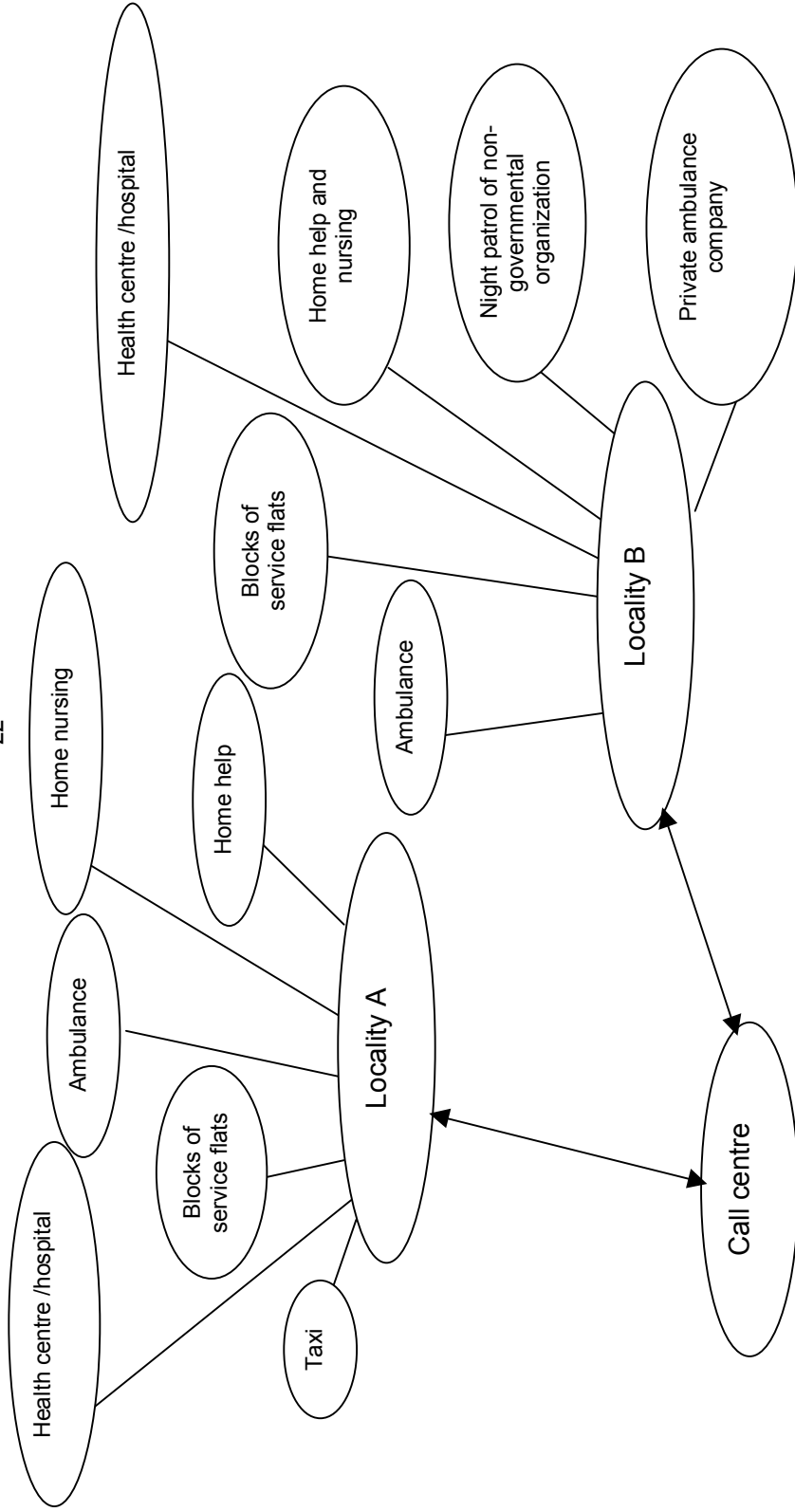
Figure 1. Variety of actors involved in safety telephone services (examples)

The case networks are good research sites also because (i) most of them have several years of experience in the branch, (ii) they consist of many different types of actors and (iii) their core organizations have a genuine interest in promoting efficient information flows and management, but the networks have barely been studied before. The present state has not been documented either. There is accumulated knowledge for examination and documentation.

The novel organizational settings and challenges of service management call for a combination of constructive research and action science. The basis of the present dissertation is further complicated and enriched by the relationship between the end-users of the technology in question, today's aged people who are rarely experienced in utilizing technical appliances – and well-being technology, the development of which has typically been driven by engineers.

Figure 2 (adapted from Olkkonen, 1994: 72) below summarizes the action-analytic research approach of this dissertation.

Problem area

Earlier theories and research on the problem area

Selection of target unit or units

Specification of the problem

Getting acquainted with the targets

Selection of researcher's role

Observations in target organizations: actors of the case networks

Specification of method

Analysis of observations:
- information quality
- network collaboration

Theories on:
- information /know-
  ledge management
- information quality
- organizational
  communication
- network management
  /virtual teams
- innovation
  management

Conclusions and formulation of results

Effects on theory and concepts

Recommendations

Figure 2. The action-analytic research approach of the dissertation

2 Case study context

2.1 General terms and definitions

Customers – The concept of customer refers in the present dissertation to end customers – ageing persons utilizing safety telephones.

Network partners /collaborators – The concept of customers could in this dissertation also be used to refer to information customers, but for the sake of clarity, the information customers are referred to as network partners or collaborators, or by citing the different professional categories working in safety telephone services. Networks partners are the different types of organizations and/or employees involved in the virtual service networks to be investigated.

At the level of individuals, network partners are knowledge workers who require or use information in any form as part of their job function or in the course of performing a process. These knowledge workers may be immediate information customers who are in the same organization or business area as the producer of the information. Alternatively, they may be downstream information customers outside the originating organization or business area who depend on that information. (Cf. English, 1999.)

Information transfer /flows – Information transfer occurs when information is diffused from an individual or individual organization to others. It can be transferred through many different types of processes – purposefully or as an outcome of other activity. (Cf. Roberts, 2000.)

Ageing persons (the elderly, older persons, aged persons) – Different age limits are used – for instance, those aged 65 plus or 75 plus. In the context of the use of safety telephones, an age limit is not necessary. Although the use of these telephones is commonly associated with higher age, they may also be used by, for instance, younger disabled persons. A common aspect of elderly persons is their age, but otherwise they are a heterogeneous population with differing requirements and subgroups (Bouma, 1998). In the present dissertation, the use of the term 'ageing persons' instead of the others mentioned above is justified by the view that the use of well-being technology could and should be started earlier than is done at present – technology might benefit new groups of people

and be utilized more efficiently, if the users had more energy and time to get acquainted with it.

Safety telephones – An apparatus with a big button and a pendant or chain around the neck, or a wristband with also a help button on it. One can give an alarm by pushing the button. They have also been called 'safety alarm systems' (van Berlo, 1998) and 'social alarm systems' (EN 50134–7, 1996). So-called well-being wristbands and mobile safety telephones are being used or tested these days. There are also various types of accessories for safety telephones today – dosers of medication, fire alarms, door alarms, epilepsy alarms and so forth.

Safety telephone service – According to the definition of Lehto and Vuoksenranta (1999), this consists of a safety telephone customer, a call centre and safety helpers who call on the customers to provide help or check up after an alarm has been given. Komminaho (1999) takes a slightly different perspective: safety telephone services contain alarm appliances, reception of alarm information, alarm and check-up visits and check-up calls. These definitions are, however, somewhat too restricted. Telephone installers and medical institutions such as health centres and hospitals need to be included. Their important roles will be illustrated in the present dissertation, and they are essential parts of *all types* of safety telephone service systems.

Well-being technology and gerontechnology – Well-being technology and wellness technology are both widely used in a similar purpose. There are also numerous other concepts in use when discussing similar phenomena – welfare technology, wellness and health telematics, wellness applications, wireless wellness monitoring, seamless interactive health care, medical informatics, health informatics, health care informatics, wellness solutions, wellness support and assistive technology are all used in varied contexts. The list is far from all-inclusive, and the use of these concepts does not seem to be very consistent.

The concept of welfare technology has been rejected, as that is easily associated with welfare state services, which are not the only interesting ones in the present dissertation. For the purposes of this dissertation, well-being technology has been selected as the most comprehensive and clearest concept. 'Well-being' refers to service needs and requirements of different groups of people and the fulfilling of these needs. 'Technology', again, refers here to technological instruments or facilities related to the service needs.

In the present dissertation, the general concept of well-being technology is interesting with regard to communicativeness of technologies or technological facilities with the relevant systems of services. The results of this dissertation will likely be useful in the development of well-being technology based services in general, not only safety telephone services. Gerontechnology, again, is a field "concerned with research, development and implementation of specific technologies for the purposes of the whole or sections of the elderly population" (Bouma, 1998: 93).

2.2 Branch of safety telephone services

"The smartness of smart homes is not within the home. […] The smartness is in the network. […] innovating complex networking technology risks technological failure and social rejection unless attention is paid to (internally and externally) aligning the organisational and technological dimensions of the innovated technology." (Kinder, 2000: 86, 88.)

The precise context in which information quality and its management in networks are looked into in the present dissertation is safety telephone services for ageing people. Various forms of such well-being technology are being vigorously developed around the world. The concept of well-being technology may cover almost anything, but in the ageing society, appliances and services that are aimed at supporting ageing people are especially relevant. The context of the present dissertation is thus timely and societally significant, as population is ageing rapidly in Finland and elsewhere.

According to population forecasts, one of four Finns is aged over 65 in the year 2030 (Tilastokeskus, 2002). The average life expectancy for a female child born in the 1990s is over 80 years, and for a male child 73 years, as compared to 75 and 65 years respectively for those born in the 1970s. The number of retired people will start to grow significantly after the year 2005. High pressure is placed on services of the ageing people of today, and the situation is not likely to get any easier or less problematic in the future.

Safety telephones and wristbands that enable a call for help by pushing just one button increase the possibilities of an ageing person to continue to live in her or his own home even when there is a need for assistance.

Ageing people usually wish to live at home as long as possible, and safety telephones are part of today's structure of elderly care in Finland.

Feelings of insecurity and fear are among the most common reasons for moving into a block of service flats or an old-age home. Safety telephones increase the user's feeling of safety and security, and their use has increased in private homes. They are also utilized in institutional settings to facilitate the work of care personnel, who can provide help more quickly in cases of need, such as when an ageing person has fallen on the floor and is unable to get up without assistance.

Of the some 70 000 safety telephones in use in Finland today, more than half have been acquired by private citizens at their own expense. The rest are owned or maintained by municipalities as part of the public service provision. It is expected that the number of safety telephones and the need for related services will increase considerably within the next decade or so, in line with the number of pensioners. Safety telephone services are offered by private enterprises (in specific geographical areas or nationally), municipalities, foundations, non-governmental organizations and cooperatives.

The system of safety telephone services includes a call centre that receives alarm calls and gives guidance to customers, or if necessary, calls out a service provider who goes to the ageing person's home to provide help. The call centre also receives notifications concerning technical faults or service needs related to telephone appliances. Call centres may be tiny internal units in old-age homes that serve only the residents, large centres that serve thousands of customers from all over the country or something from between, such as municipal centres. Safety helpers may be employees from municipal home care services, private enterprises or non-governmental organizations offering care services or even taxi drivers, depending on the place and hour of the day. The overall system is highly fragmented in Finland.

In safety telephone services that are built around a small call centre, the operations are relatively straightforward. For instance, in a call centre of an old-age home, the care personnel answers the phone, knows the persons who call – including their health condition – and can provide help to the caller in just a few minutes. In a large call centre, challenges are numerous indeed. If there are thousands of customers, there is very likely a continuous information overload (cf. Wilson, 2001), especially if the call centre's information system does not filter the incoming calls in any way.

Personnel answering alarm calls cannot know the customers or their current health condition. When services are provided in different cities and towns and in the countryside all over Finland, the situation is very demanding with regard to the collaboration network of the call centre. There have to be people who are ready to provide help at all hours of the day and who can be reached immediately without any problems. The network deals with matters of life and death – an alarm call can be the last call of that person.

2.3   Functioning of safety telephone services

A safety telephone customer may call for help by pushing the button on her/his wristband or pendant. The customer is then connected to the call centre and may communicate by speech with the person in charge at the centre. The safety telephone requires the customer to be conscious of the need for help and to be active in getting in contact with the call centre. The service provider must arrange a quick and effective response to an alarm signal at all times. The type of response depends on the type of reason for alarm call.

Examples of the types of response are as follows:

   a) friendly verbal advice using the two-way speech system,
   b) calling out designated helpers,
   c) calling out municipal health or social services staff,
   d) calling out emergency services such as ambulance, fire services or police,
   e) calling out designated key-holders or
   f) making arrangements for forcible entry.

The above list is from the European Standard concerning alarm systems (EN 50134–7:1996), which has the status of a Finnish national standard. In practice, the variation in who helps the customer is large. In addition to municipal staff and emergency services, safety helpers may be employees of the company operating the call centre, volunteers or paid helpers of a non-governmental organization, employees of a cooperative or a foundation offering home care services, or some others, such as near relatives.

Call centre staff passes on personal, medical or environmental details as are appropriate to helpers or services called out. Service providers may

have established a maximum response time for the provision of help to the customer – for instance, 30 minutes. After the provision of help, the safety helper normally fills in a form indicating the name of the customer, reason for the visit and actions taken, and leaves it with the customer. Keys to the customers' homes may be held at the call centre or elsewhere. Keys may even be carried on by the safety helper within small local systems. Virtually all the characteristics of safety telephone services depend on the type of the system – whether it is an internal system of a block of service flats, a system operated by the municipality, by several municipalities together, by a company in a certain geographical region, a foundation or a company on a nation-wide basis. The customer basically gets the same service in each of these systems, but how it all operates 'behind the scenes' varies greatly (for examples, see Figure 3). In the present dissertation, internal systems of blocks of service flats receive lesser attention than the types that place bigger challenges on the service network.

Safety telephone appliances are being developed and new appliances such as so-called well-being wristbands and mobile safety telephones have been invented. However, while the technology is largely in existence, there is still a lot to be done to further its sober application. It is vital to pay increasing attention to the service systems related to the use of safety telephones. The provision of services to customers using safety telephones is highly dependent on communication network structures, where information is the way of coordinating operations. Due to heterogeneity of network participants, the traditional point of view of information systems has been rejected in the present dissertation. The perspectives here are information quality and the human factor covering the degree, organization and management of collaboration within the networks investigated.

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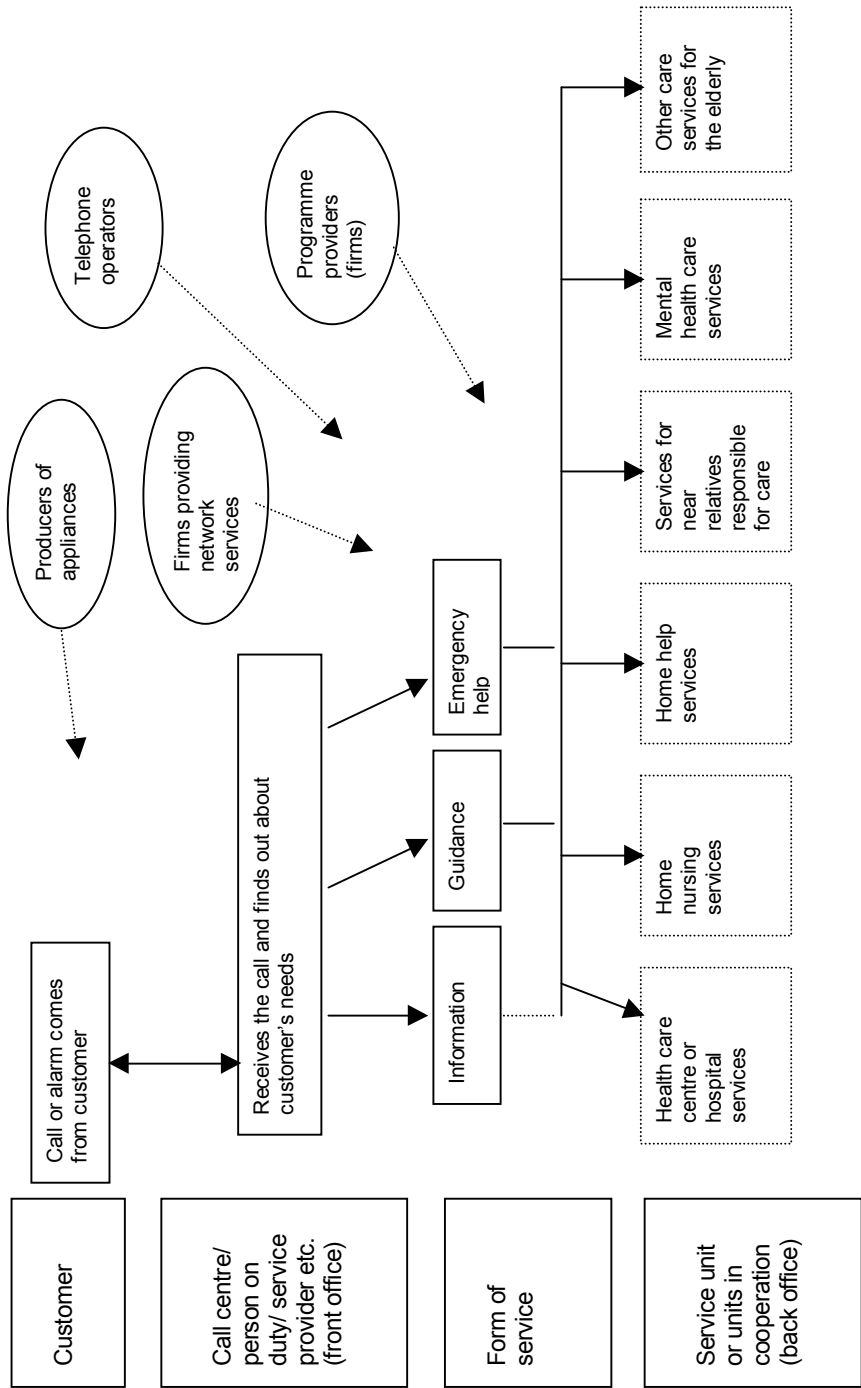
Figure 3. An example of a municipal safety telephone service network

3 Review of existing literature

3.1 Information management

3.1.1 From data to information

Definitions of information have followed two patterns, either (i) focused on information (and knowledge) being fundamentally different from data (which is called the hierarchical view) or (ii) emphasized that some knowledge is needed before data and information can be created. There are also studies in which data, information and knowledge are used interchangeably, or in which one or two of these concepts are used without any clear definitions. Huang, Lee and Wang (1999) note that in practice, managers tend to differentiate information from data intuitively, and in their book, they use 'information' and 'data' synonymously unless otherwise specified.

Lillrank (2003), a representative of the hierarchical view, defines data as the factual content of information. Devoid of context, a number, for instance, carries no meaning – it is thus data. Meaning, again, is a function of data and its context, and only meaningful information can be the basis for purposeful action.

Wolstenholme, Henderson and Gavine (1993: 2), on the other hand, state that "data itself is useless until some thought has been applied to its meaning". In their view, data thus have a meaning, but that is not enough. They see adding value to raw data or unsophisticated information by human or computer effort as one of the main tasks of management, as management decision-making processes are grounded upon information. What remains unclear in their work, however, is the difference between 'unsophisticated' and 'sophisticated' information.

In his earlier work, Lillrank (1997: 16) maintains: "Observations of states and events of the world … are translated into standardized symbols (numbers, words) i.e. data which allows storage, retrieval, comparison, aggregation and analysis. When data is being put in a meaningful context and processed, it becomes information. […] Information transforms into a component of knowledge, when it is analysed critically and its underlying structure is understood in relation to other pieces of information and

conceptions about how the world works […]". Similar categorizations have been presented recently by, for instance, Roberts (2000) and Miller et al. (2001).

Information has also been described by five 'C-words': Contextualized, Categorized, Calculated, Corrected and Condensed. The 'C-words' for knowledge again include: Comparison, Consequences, Connections and Conversations. (Davenport and Prusak, 1998.) In the case of information, these illustrative words set high standards. These standards already enter the field of information quality insofar as they describe information as, for instance, corrected. This comes close to accuracy, a dimension of information quality.

Tuomi (1999) represents the second approach mentioned above, which could perhaps be called 'the inversely hierarchical view'. Tuomi argues that the typical paradigm of the research literature, 'data becomes information becomes knowledge', only tells part of the story. Information can be created only after there is knowledge, and data emerges as a by-product of cognitive artifacts that assume the existence of socially shared practice of using these artifacts.

The essence of these two approaches could be illustrated as two simple triangles (Figure 4).

Data

Information

Knowledge

Knowledge
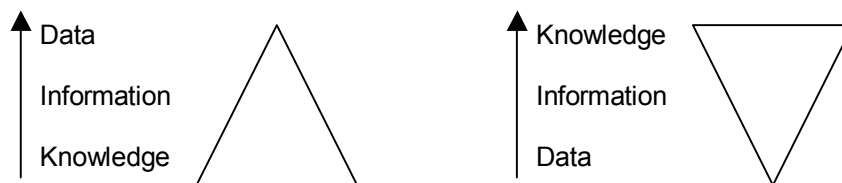
Information

Data

Figure 4. Which comes first – data or knowledge?

An interesting example of a study that only deals with data (and data quality) was done by Wang and Strong (1996). The authors have since then written also on (quality of) information, but the article from 1996 with thought-provoking and timely findings did not discuss data as such at all. A look at the data quality dimensions discussed in Wang and Strong's article reveals, however, that their understanding of the concept of data was not very narrow. For instance, the quality dimension of believability is defined as the extent to which data are accepted or regarded as true, real and credible. If we only have, for instance, a number devoid of context,

we cannot assess its credibility. The same applies to all the quality dimensions in Wang and Strong's article; they would be useless in practice if data were understood in the narrow way, as being at the bottom of a hierarchy.

Let us engage – very briefly – in an unscientific exercise and consult a few dictionaries. The Concise Oxford Dictionary gives the following explanations for data, 'facts or information, especially as basis for inference; quantities or characters operated on by computers etc.' and information, 'thing told, knowledge, (desired) items of knowledge, news'. A brief look into a few other languages shows that in the French language, there is a clearer distinction between 'données' (data) and 'informations' (information). In the Swedish and German languages, the difference is clear, too, whereas in the Finnish language, there is practically no difference between the translations of the above two concepts. In Spanish, there also seems to be some ambiguity (computer data = datos, but a piece of information = una información, un dato). In the Japanese language, again, the difference seems to be relatively clear. The point of this unscientific exercise is that we naturally have to consider definitions carefully, but perhaps see them as supportive rather than binding.

Information theories have traditionally been divided into syntactic, semantic and pragmatic – and they emphasize that information is a message's characteristic (Åberg, 2000). A revolutionary view has been offered by Wiio (1989), who analyzed the concept of information from the point of view of systems theory. Information is an act, a process. It is a change within a person's control system: an electro-chemical work process, through which the parts of the control system are temporarily or permanently rearranged. Such a definition is appropriate for the present dissertation, even though the dissertation does not concern persons' control systems but information transfer and organizational matters. The definition of information as an act and a process provides a natural basis for combining the analysis of (i) quality of information and (ii) network collaboration.

3.1.2   From information to knowledge and further

Between 'information' and 'knowledge', there is also still considerable conceptual unclarity. They are usually strictly separated (e.g., Bukowitz and Williams, 1999; Nonaka and Takeuchi, 1995; Nonaka and Teece,

2001). In other cases, they are used side-by-side, understood as having an almost similar meaning (e.g., Soete and Tindemans, 2000). Some researchers particularly emphasize that despite their difference, the relationship between information and knowledge is interactive (Roberts, 2000; cf. English, 1999; Huang, Lee and Wang, 1999).

If there is unclarity between the concepts of information and knowledge, the situation is further complicated by different types of knowledge – explicit, tacit and self-transcending (for discussions on explicit and tacit knowledge, see, e.g., Nonaka, 1990; 1991; 1994; Nonaka and Takeuchi, 1995; Nonaka, Toyama and Konno, 2001; Takeuchi, 2001; and for discussions on self-transcending knowledge, see Scharmer, 2001; Harmaakorpi, Melkas and Kivelä, 2003).

It seems that those treating information and knowledge as different but relatively equal have not been particularly numerous until these days. Miller et al. (2001) note that one reason for the general confusion occurring in conceptual discussions may be caused by a 'chaining process' that takes place in organizations. Some explicit knowledge may be treated as data by higher level processes. Explicit knowledge also may be sent to decision-makers who view it as information. Certain information may likewise be treated as data by higher level processes. Recognizing and understanding this chaining process may contribute to perceiving the complexity of the field. (Miller et al., 2001.)

Studies focusing on either one of the concepts – information and knowledge – have also been undertaken without even discussing their difference or similarity (see, for instance, Cowan, Soete and Tchervonnaya, 2001). An extensive study of the concept of knowledge has been undertaken by Tuomi (1999), whose work consists largely of theoretical meditations on the concepts of knowledge, intelligence and meaning making. Tuomi criticizes what he calls a traditional, common sense realist view of knowledge and presents a phenomenological-constructivist view of knowledge represented by Henry Bergson as an alternative. The largest part of the work elaborates on the concept of intelligence on the basis of Maturana and Varela's theory of biological knowledge and Niclas Luhmann's theory of social systems and meaning processing in communication. These are complemented with ideas from Lev Vygotsky and Aleksei Leontjev, who represent the cultural-historical activity theory (for further details on Tuomi's work, see Melkas and Uotila, 2003).

Nonaka and Teece (2001) note that information is data, sometimes old, sometimes new, but knowledge is superior – it involves the understanding of how something works. Knowledge requires the understanding of interrelationships and behaviour and is context-dependent. Their discussion seems to reflect a fairly typical attitude among advocates of knowledge management. The need to draw a definite line between knowledge and research on knowledge management, on the one hand, and research on information and information management, on the other hand, is perhaps too emphasized. Nonaka and Teece (2001), for instance, seem to reserve context dependence for knowledge only. They do not engage in the discussion of all the related concepts from data to information to (different types of) knowledge to, for instance, awareness. Their contention that information is data thus appears to be an oversimplification.

The relationship between information and explicit knowledge is interesting. What is the difference? Scharmer (2001) gives practical examples of different types of knowledge. The statement "this bread costs one dollar" is, to him, an example of explicit knowledge, whereas embodied tacit knowledge is related to actually baking and producing bread – not just talking about it.

On the basis of Scharmer's arguments, there does not seem to be any difference between information and explicit knowledge (cf. also Ståhle and Grönroos, 1999: 82; Huang, Lee and Wang, 1999). Baking and producing bread, again, does not seem to be an accurate example of embodied tacit knowledge. Cookbooks codify the knowledge of baking, and you can succeed by following their instructions, even if you would not know of certain practical tricks that are useful in baking. It seems that those tricks could serve as examples of embodied tacit knowledge, but not the art of baking itself. Anyone who bakes rarely is likely to check a few things in a cookbook. However, if one has never baked bread, it may seem like a magical, mystic skill – which it is not.

Nonaka, Toyama and Konno (2001) argue on the difference between information and knowledge that, for example, "1234 ABC Street" is just information. However, when put into a context, it becomes knowledge: "My friend David lives at 1234 ABC Street, which is next to the library." (Nonaka, Toyama and Konno, 2001: 14). The example of "1234 ABC Street" is, however, not quite convincing. One could also claim that "1234 ABC Street" is data (from a database, for instance), whereas the longer sentence given by Nonaka, Toyama and Konno would be information.

To continue a little, explicit knowledge – or further information – could then be: "To go to David's place from here, you have to take the subway, get off at Leicester Square and walk 100 metres to the North until you see a red brick house". Adding "But he is not at home today, as he mentioned last week that he would leave for Japan very soon" could then serve as an example of (embodied) tacit knowledge. In all, drawing the lines with such examples appears to be problematic indeed.

Information has lately been discussed as a product, a production factor and – from a larger perspective – as a deliverable. A deliverable may be a product, a service, information or a combination of these that is planned and implemented for a customer (Lillrank, 1997). Lillrank further emphasizes how large, confusing and intellectually challenging task it is to understand and manage information and information flows. Information "guides the manufacturing operation to purchase the right components to assemble and ship the right product at the right quantity on the right time for the right customers accompanied with the right user information, after service, traceability and customer feedback channels" (Lillrank, 1997: 4).

With regard to services, such as safety telephone services, the above sentence by Lillrank could be amended and expressed as follows: *information guides the coordinating operation to mobilize the right network organizations and safety helpers to provide the right help to the right extent on the right time for the right customers accompanied with the right after service (integration with other services), traceability and customer feedback channels*. User information is, of course, also relevant when a safety telephone is given to a new customer.

The generic elements of information are content, form and context (Figure 5). Pieces of information also have life-cycles, as do physical products. Information can be either (i) a trigger of action (acts as a signal); (ii) an enabler of action or a desired mental state (acts as a symbol); (iii) nice to know (may trigger or enable action later or in a different context) or (iv) useless (discarded immediately). (Lillrank, 1997: 25.)

| CUSTOMERS
- consumer – investor
- chooser – payer – user
- customer – client | BUSINESS PROCESS
- flow – stock
- signal – symbol | TIME
- information life-cycle: creation – potential – actual – latent – extinct |

CONTEXT
Intended use

| CONTENT
What does it say? | FORM
How is it said? |
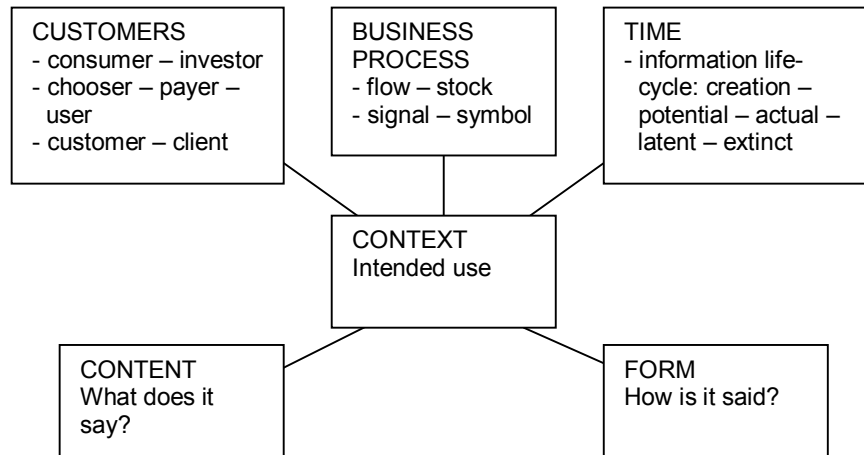
Figure 5. The generic elements of information
Source: Lillrank, 1997: 19

A further approach to defining information comes from studies on organizational communication. Information – verbal and nonverbal – is the basic raw material of communication, and it takes form when meaning is invested in it. When two or more persons engage in verbal and nonverbal transaction, they are involved in generating, perceiving and interpreting information. When a shared meaning or a common interpretation results from this process, communication has occurred. In a simple sense, information thus includes any kind of pattern that a person can observe or sense in the environment, and meaning occurs when information is placed within a context. (Daniels, Spiker and Papa, 1997: 92-93.) This illustrates the difference in perspectives between communication studies and management studies. The dichotomy between information and knowledge is not discussed.

Huang, Lee and Wang (1999) provide in their outstanding book on quality information and knowledge several useful working definitions: knowledge as quality information, knowledge as competency, knowledge as a 'hardened', systematic product. The authors distinguish between 'know-how', 'know-what' and 'know-why' knowledge, which is a useful classification between factual, instrumental and explanatory kinds of knowledge (cf. also Lee and Strong, 2004). When information has a suitable number of quality features, that information becomes knowledge in the full sense. Knowledge is thus made relative to information, but gains in engagement with real world contexts. Information is also given

the value needed. The result in Huang, Lee and Wang's (1999) work is a successful practical and instrumental operationalization.

Miller et al. (2001: 365) summarized data terminologies as follows:

Data	A representation of an object.
Information	The aggregation of data into something that has meaning (semantics) through interpretation by human or automated processes.
Knowledge	That which is derived and inferred from assimilating information against perceived context, experience or business rules.
Decision	A process for arriving at a solution to a problem, using knowledge to assess and judge information.
(Situational) Awareness	The assessment of information into decisions and actions, guided by knowledge of the contextual domain.

3.1.3 Management of information

"If the right piece of information in the right format is at the right place at the right time, action is relatively easy and predictable" (Lillrank, 1998: 7; cf. English, 1999: 31). This was not given as a definition of information management, but it could serve as an 'inofficial' definition. Lillrank (1998) further states that 'the world of information' has its limitations, since it allows only permutations of known elements following known rules; continuous improvement requires knowledge. While agreeing with that, the present dissertation is built on the conviction that an important first step in improving organizational communication processes consists of analysing information itself and its quality and management, especially in novel organizational structures such as service networks (cf. Huang, Lee and Wang, 1999).[1]

It seems that the meaning of the concept of information management is regarded as self-evident in many studies. Straightforward definitions of information management are not usual in studies where it is discussed. In a doctoral dissertation, for instance, the concept features in the title, but no definition is given (Viitanen, 1998). The discussion moves around

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[1] Lillrank (1997: 33) also notes: "After getting a reasonable control over the quality of information in repetitive processes, we may want to move ahead to the one-of-a-kind quality attributes, the positive surprises of attractive quality. Here, however, we approach the world of knowledge and that is a different story."

information management systems and information systems without touching upon the problematics of information management itself. On the other hand, in a Finnish book on management of communication, knowledge management and information management are regarded as analoguous concepts (Åberg, 2000: 209).

Miller et al. (2001: 366) have usefully summarized the different management terms that are relevant in the context of the present dissertation:

Data management	The process of ensuring that needed data is available and properly understood.
Information management	The process of determining the information objects required for systems and processes to perform their functions and to interoperate.
Information dissemination management	Managing access to and transfer of information objects using multiple communications services.
Knowledge management	A collaborative approach to identifying, capturing, evaluating and sharing knowledge, particularly tacit knowledge resident in the expertise and experience of individuals and processes, to provide a shared awareness of the state of the enterprise's environment.
Decision management	The (collaborative) process of generating, evaluating and supporting the selection of a plan of action.

The typology does not contain information quality management, however. For the purposes of the present dissertation, three categories are aggregated. Information management is here understood as covering both data management, information management and information dissemination management.

On the difference between information and information systems, Lillrank (1997: 23) notes that they can be seen as separate but interdependent entities. While information is a constellation of bits in context, an information system is the manipulation and transmission of bits. The quality of information systems (excluding the information content quality) can be analysed as the quality of any production system. According to Lillrank, the generic elements of information systems are hardware, software and humanware.

Takeuchi (2001) contends that Western managers take for granted a view of the organization as a playing field for 'scientific management' and a machine for 'information processing'. This view is deeply ingrained in the traditions of Western management. The view of organization as an information-processing machine has been severely criticized. Nonaka, Toyama and Konno (2001) see organization as an entity that creates knowledge by virtue of its actions and interactions with its environment. They argue that the traditional information-processing machine view of organizations is static and passive and fails to capture this dynamic process of knowledge creation. The most important aspect of understanding a firm's ability concerning knowledge is its dynamism in continuously creating new knowledge out of existing firm-specific abilities. (Nonaka, Toyama and Konno, 2001.)

The view adopted in the present dissertation is, however, that discussions of information management, processing and transfer do not have to mean that we are assuming a static and passive view of organizations. The relationship between information management and knowledge creation, for instance, is tight. In studies of information content and quality, it is also necessary to understand the dynamics of the processes related to information transfer. Good information quality helps greatly in knowledge creation (cf. Huang, Lee and Wang, 1999).

Wang, Lee, Pipino and Strong (1998) advocate the so-called information product (IP) approach to information management. Organizations should not treat information as a by-product. They should, instead, follow four principles (Wang et al., 1998: 95-96):

1. Understand consumers' information needs.
2. Manage information as the product of a well-defined production process.
3. Manage information as a product with a life cycle.
4. Appoint an information product manager (IPM) to manage the information processes and the resulting product.

With regard to the first principle, the needs of two types of consumers need to be determined: the external customer and the internal information consumer. With regard to the second principle, Wang et al. note that a poorly defined information production process is likely to lead to, for instance, updating of customer information on an *ad hoc* basis when convenient. The information product life cycle is defined as the stages through which information passes from introduction to obsolescence.

Wang et al. divide it into four stages: introduction (creation), growth, maturity and decline. (Wang et al., 1998.) The thinking of Wang et al. is especially relevant for the purposes of the present dissertation.

Nonaka and Teece (2001) claim that the important distinction between information management and knowledge management is too frequently overlooked. On the contrary, it is argued that the important interrelationship between these is nowadays often overlooked. This may be one of the reasons for practical problems in organizations. (Uotila and Melkas, 2003.) It does not seem to be meaningful to see them as analoguous concepts, but their strict separation – based on seeing one of them as having higher value than the other – is not likely to contribute to better collaboration and understanding between, for example, different units in an organization. These latter arguments are based on the much wider view of information management in the present dissertation than the traditional information systems and information technology centred approach.

3.2 Information quality

"Imagine there were a measurement system for information quality; a small device the size of a cellular phone that we could carry around as we walk through a business process from order receiving to the shipping dock, from cubicles to the corner office. At each process step you would stop, activate the device and get a valid and reliable measure of the quality of both the incoming and outgoing information. After completing the round, you would plug the device into a computer for a full analysis of the quality of the information. Would it be useful?" (Lillrank, 1997: 4.)

Information quality is not an entirely new concept, but it has gained increasing attention during the last few years, also in business communities. Information quality has been studied overwhelmingly by researchers interested in computing, management information systems, databases and their management, data security and data warehouse quality, to mention a few. The concept of data quality has been used to a greater extent earlier than the concept of information quality. Researchers have concentrated on company environments and business information (cf., e.g., English, 1999; Huang, Lee and Wang, 1999; Chengalur-Smith, Ballou and Pazer, 1999; Wang et al., 1998; Allen, 1996; Wand and Wang, 1996; Wang, 1998; Paradice and Fuerst, 1991).

Recently, several doctoral dissertations have been written in the United States on information quality – for instance, the impact of information quality and ergonomics on service quality in the banking industry (Najjar, 2002); the effect of information quality on supply chain performance (Petersen, 1999); and the impact of communication media characteristics on information quality perceptions in business-to-business purchase decision-making (Citrin, 2001). Studies of information quality in heterogeneous service networks consisting of organizations from different sectors – and with incompatible or missing information systems such as in the present dissertation – have not been undertaken.

Definitions

Conventionally, information quality has been described as how accurate information is. Huang, Lee and Wang (1999) claim in their comprehensive 'guidebook' that no standard definition for the concept exists. English (1999: 27), again, represents information by the formula:

Information = f(Data + Definition + Presentation)

These three components make up the finished product of information. Each of them must have quality to have information quality. "If we do not know the meaning (definition) of a fact (data), any value will be meaningless and we have nonquality. If we know the meaning (definition) of a fact, but the value (data) is incorrect, we have nonquality. If we have a correct value (data) for a known (defined) fact, but its presentation (whether in a written report, on a computer screen, or in a computer-generated report) lacks quality, the knowledge worker may misinterpret the data, and again we have nonquality." (English, 1999: 27.)

English (1999: 22) further defines information quality by dividing it into inherent and pragmatic information quality. Inherent information quality is the correctness or accuracy of data, whereas pragmatic information quality is the value that accurate data have in supporting the work of the enterprise. English (1999: 24) lists also two general definitions: (i) information quality is consistently meeting knowledge worker and end-customer expectations through information and information services, enabling them to perform their jobs efficiently and effectively and (ii) information quality describes the attributes of the information that result in customer satisfaction. Wang and Strong (1996: 6) define 'data quality' briefly as "data that are fit for use by data consumers".

Earlier research approaches to study information quality have been divided into (i) an intuitive, (ii) a theoretical /system and (iii) an empirical approach (Wang and Strong, 1996; Huang, Lee and Wang, 1999). In the present dissertation, the approaches to studying information quality are more appropriately classified as follows:

- a customer requirements based approach,
- a quality dimensions based approach,
- a technical quality versus negotiated quality approach.

The customer requirements based approach

Relatively early representatives of the customer requirements based approach – or, in fact, a kind of a combination of the first two approaches – were Lane Keller and Staelin (1987). They defined information quality as the information's inherent usefulness to consumers in assessing the utility of an alternative. In studying the effects of quality and quantity of information on decision effectiveness, they operationalized information quality as the cumulative score of an individual's importance weights for certain attributes provided. In that case, the attributes were associated with job preferences. Lane Keller and Staelin came to the conclusion that consumer's perceptions of the usefulness of an informational environment are strongly associated with their measure of information quality – the consumer's cumulative or total importance weights for the attributes made available.

The quality dimensions based approach

Lists of information quality dimensions have been produced by, inter alia, Strong, Lee and Wang (1997a; 1997b), Wang and Strong (1996), Wang et al. (1998), Wang (1998), Wolstenholme, Henderson and Gavine (1993), Lillrank (1997), Huang, Lee and Wang (1999), Dvir and Evans (1996) and English (1999).

Wang and Strong (1996) report the results of a study that identified the attributes of data quality that were important to data consumers. The concept of data is used here in accordance with the original article and with the understanding that it is not in contradiction with the concept of information. Wang and Strong took an empirical approach to studying data quality. They followed the methods developed in marketing research

for determining the quality characteristics of products. They first collected data quality attributes from data consumers, then collected importance ratings for these attributes and structured them into a hierarchical representation of data consumers' data quality needs.

From initial 179 data quality attributes Wang and Strong (1996) developed a hierarchical framework with four data quality categories and fifteen dimensions (Figure 6): (i) intrinsic data quality consisting of accuracy, objectivity, believability and reputation; (ii) contextual data quality consisting of value-added, relevancy, timeliness, completeness and appropriate amount of data; (iii) representational data quality consisting of interpretability, ease of understanding, representational consistency and concise representation and (iv) accessibility data quality consisting of accessibility and access security.

The quality attributes were collected from data consumers instead of being defined theoretically or based on researchers' experience. Wang and Strong justify their framework by the fact that a data quality framework had not existed before – and one was needed to enable measurement, analysis and improvement of data quality in a valid way. Their framework provides a basis for deciding which aspects of data quality to use in any research study. The definitions for all the dimensions are listed in Annex 2.
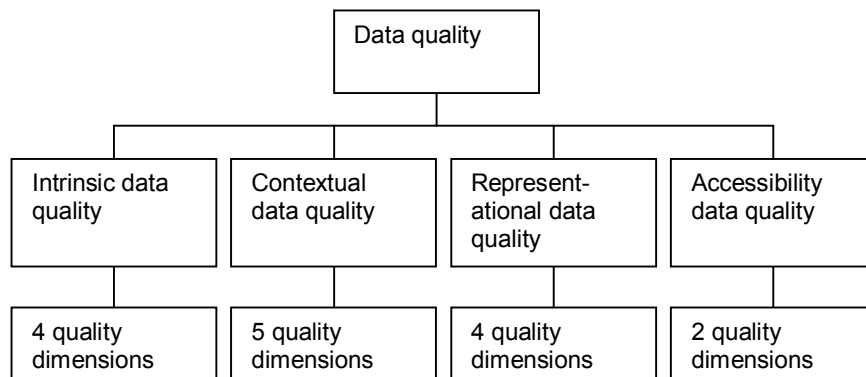
Figure 6. Hierarchical representation of data quality
Source: Wang and Strong, 1996: Figure 2

Wang and Strong's framework has more dimensions than works of some other researchers. Earlier, most studies were based on a small set of quality attributes that were commonly selected (for instance, accuracy

only). The framework has been utilized and advocated later by Wang et al. (1998), Wang (1998), Huang, Lee and Wang (1999), Kahn, Strong and Wang (2002) and Lee, Strong, Kahn and Wang (2002). Parts of it are applied also in the present dissertation.

Lillrank (1997: 26-27) had a different approach. He listed three quality attributes for the content of information: reliability (true or false), validity (relevant to irrelevant) and accuracy (effective to ineffective). A piece of information may have various combinations of measures along these attributes. Based on the assumption that the values are discrete, either exist or do not exist, Lillrank (1997: 28, Figure 11) presented eight possible combinations:

1. "Information is true, relevant and effective, that is, of highest quality.
2. Information is false, but relevant and effective, at least in the short term, as when a conscious lie or unconscious self-deception produces an intended effect.
3. Information is true, but irrelevant, but still effectively producing actions, as when an out-of-context statement in a brainstorming session leads to valuable new ideas.
4. Information is false but irrelevant, but may still effectively cause fear, panic or suspicion.
5. Information is true and valid, but not able to produce any effects; it may be called trivial.
6. Information is false, but valid and ineffective, such as a glib political speech.
7. Information is true, but irrelevant and ineffective, as a lot of the useless information coming up in an Internet search.
8. Information is false, irrelevant and ineffective, that is, completely lacks quality."

The quality of information form is discussed separately in Lillrank's conceptualisations (1997). It is analogous to product form in the sense that form carries the intended function. It tells about the quality of execution – how well the intended content is transferred to the customers (pragmatic utility and elegance of design). In a later work (1998: 7), Lillrank presents one further concept related to information: information intensity. It concerns the information investment of products versus processes – whether the investment is spread out over many copies or to only a single unit, always a prototype. Information intensity can be

regarded as being related to quality dimensions such as cost-effectiveness.

The quality of information systems, again, concerns the capability of the system to repeatedly deliver high quality content and form. Lillrank distinguishes three quality attributes for this (1997: 28-30): (i) precision (the ability to repeatedly hit a target); (ii) flexibility (a system's ability to redefine its targets in changing conditions) and (iii) ease of use (usability; ease/difficulty of using an information system).

Wolstenholme, Henderson and Gavine (1993: 2-3) classify information attributes under five headings: accessibility, relevance, comprehensibility, timeliness and accuracy. Their definitions for these concepts are almost similar to those for the corresponding concepts of Wang and Strong. The following remarks are of additional interest:

- *Relevance:* "For information to be relevant it must at some stage be sifted and presented, both of which are complex information-processing tasks in themselves. Succinctness is a factor bearing on relevance, but must not be allowed to compromise on completeness."
- *"Comprehensibility* of information relates to the format of its presentation and its match to the particular needs of a decision-maker. It is entirely conceivable that any ambiguity deriving from presentational format could impair the choice and the resulting effectiveness of an associated decision."
- *Timeliness:* "A preference to minimise or at least limit the time taken from information query to receipt. Lateness of information may occur because of in-built delays in the system, stemming either from particular system designs or organisational structures and procedures. But delays may also occur because of weakness of information received (incomplete, insufficiently accurate, irrelevant, etc.), which impels the user to repeat the request or substitute another. Incomplete or prolix information may also hinder end-user activities."
- *Accuracy* is closely linked to timeliness. "The accuracy of the information available to a decision-maker is measured in terms of the difference between the decision-maker's perception of the state of a variable and the true state of the variable. It is a function of both time and error factors. Time factors include the delays involved in reporting, transmitting, accessing and assimilating

information. Error factors to be considered are those inherent in the methods of observation, reporting, transmission and transcription."

The technical quality versus negotiated quality approach

As to the third approach, Lillrank (2003) discusses (i) technical quality applied to artifacts and (ii) negotiated quality in the context of information quality. Negotiated quality is interactive quality of deliverables produced as results of negotiations between producers and customers. Insofar as the distinction of information-as-artifacts and information-as-deliverables is used, technical quality and negotiated quality considerations and assessments may be utilized in studying information quality. Lillrank suggests a list of six points that should be taken into account when assessing the quality of information:

- The unit of analysis or the system level must be defined clearly (including those that take part in information exchanges and communicative acts used to initiate, guide and control business processes).
- Can the receiver capture the intended meaning of the sender? To what extent can the actors develop shared meanings?
- The data, taken as an artifact, should be checked for quality attributes, such as accuracy or reliability.
- How do the actors understand the relevant context?
- Do the actors have similar or different knowledge of how the world works?
- If actors still have very different meanings, it may be appropriate to focus on tacit knowledge and motivational factors.

The above points also reflect the close relationship between knowledge management and information quality. Lillrank (2003) maintains that studies should initially focus on information and information flows in rather well defined organizational processes where the number of players is restricted, activities have an aim and established performance indicators can be used. Consensus about overall goals and shared values should be assumed. Developing a meaningful methodology for analysing the quality of information still requires a significant amount of research. (Lillrank, 2003.) There are, however, solid quantitative methodologies (e.g., Lee, Strong, Kahn and Wang, 2002).

Lillrank's research criteria seem strict. In fact, were they applied, the whole branch of safety telephone services might fall out of suitable research topics with regard to information quality. Consensus about overall goals and shared values, for instance, does not seem to be a prerequisite for meaningful investigations. In safety telephone services – depending on the service environment – such an atmosphere does not necessarily prevail, but they still provide a relevant and challenging case study environment for the present dissertation.

Coming back to the more traditional ways of looking into information quality, Lillrank (2003) criticizes the customer requirements based approach to defining information quality. He notes that it can only be used in situations where users know what they are supposed to know and are able to define their information requirements *ex ante.* When we are dealing with operations such as safety telephone services, it seems that the customer requirements based approach should be kept in mind. Particularly a combination of the customer requirements based approach and the information quality dimensions based approach might be useful. One approach supports the other, and the information quality dimensions approach may guide users in specifying their requirements and articulating their needs. This, again, is likely to be useful in practical development work in organizations and networks. In the present dissertation, however, a combination is beyond the scope.

According to Lillrank (2003), the quality dimensions based approach makes no distinction between information itself and context dependent elements (timing and reputation). It also leaves the question about information as an output and a process vague. There are several ways in which Lillrank's legitimate criticism can be taken into account (see, for instance, Harmaakorpi, Melkas and Kivelä, 2003). When choosing the appropriate approach, type of network and phase of network's development need to be considered. The present dissertation develops a framework of analysis that is designed – on the basis of Wang and Strong's (1996) work – for established service networks, where an assessment of existing practices is essential. A different approach is necessary in, for instance, emerging innovation networks.

Finally, a point of view from organizational communication theories needs to be mentioned. The various functions of organizational communication are all related to the purpose of reducing uncertainty (Weick, 1979). Since information is the key here, members of organizations are usually concerned with the adequacy of this information (Daniels, Spiker and

Papa, 1997). Problems associated with information adequacy have been explained by employing Brillouin's (1962) distinction between absolute and distributed information (Farace, Monge and Russell, 1977).

Information adequacy problems may arise because a piece of information does not exist in the organization's pool of absolute information, or because existing information is not properly distributed. Little effort has, however, been made to study information adequacy by systematically matching an organization's information needs against both absolute and distributed information to identify the sources of adequacy problems. Many assume that inadequate information usually results from distribution problems and focus on individual organization members as receivers of distributed information. (Daniels, Spiker and Papa, 1997.)

The information needs of an organization – not to mention a network – as a whole are insufficiently investigated. Daniels, Spiker and Papa (1997: 106) note that the purposes and outcomes of organizational communication are more complicated than current models of communication functions and information adequacy suggest. They conclude: "It would also be useful to extend the study of information adequacy beyond the needs of individuals as information receivers. We need to know more about the ways in which system and subsystem information needs are defined and how these needs are fulfilled through organizational communication." (p. 107). This is where information quality considerations are a logical step.

3.3 Knowledge management

Knowledge – an old concept, dating back to 400 BC is being heralded today as one of the newest ideas in management (Takeuchi, 2001). There are conflicting views on the difference between knowledge management and information management. According to Tuomi (1999: 32), it is sometimes claimed that knowledge management systems are information management systems. On the other hand, a strict separation is often made between them.

Tuomi (1999) himself views knowledge management systems as 3rd generation information management systems, in which information technology is seen as embedded in broader socio-technical systems. Key concepts include

- tacit knowledge,
- organizational learning,
- organizational flexibility and agility,
- cognitive efficiency,
- intellectual and social capital,
- intelligent organizations.

Figure 7 summarizes Tuomi's thinking on the various disciplines of knowledge management. Information management is not included in the figure, but information flows are found under organizational communication.

Figure 7 could also be redrawn as stages of a 'process' following each other – instead of analogous disciplines and sub-disciplines. The stages of the 'process' would be as follows: (i) organizational information processing (with sub-disciplines); (ii) organizational intelligence; (iii) knowledge management and (iv) organizational development (that is, the aim of knowledge management). This way of looking at the disciplines might be more useful with regard to practical management questions. (Melkas and Uotila, 2003.)

One of the practical areas of knowledge management is the one that relates to innovation and knowledge creation in organizations. The precise meaning of knowledge management is unclear to many. Practitioners in organizations may point out, for instance, that "we don't know what knowledge management is, but we sure know it is not happening here" (Tuomi, 1999: 17). According to Tuomi, part of the confusion around knowledge management results from the fact that several disciplines contribute to it, and different starting points lead to different conceptualisations. In practice, knowledge management is very much about incremental change guided by long-term conceptual vision. (Tuomi, 1999.)
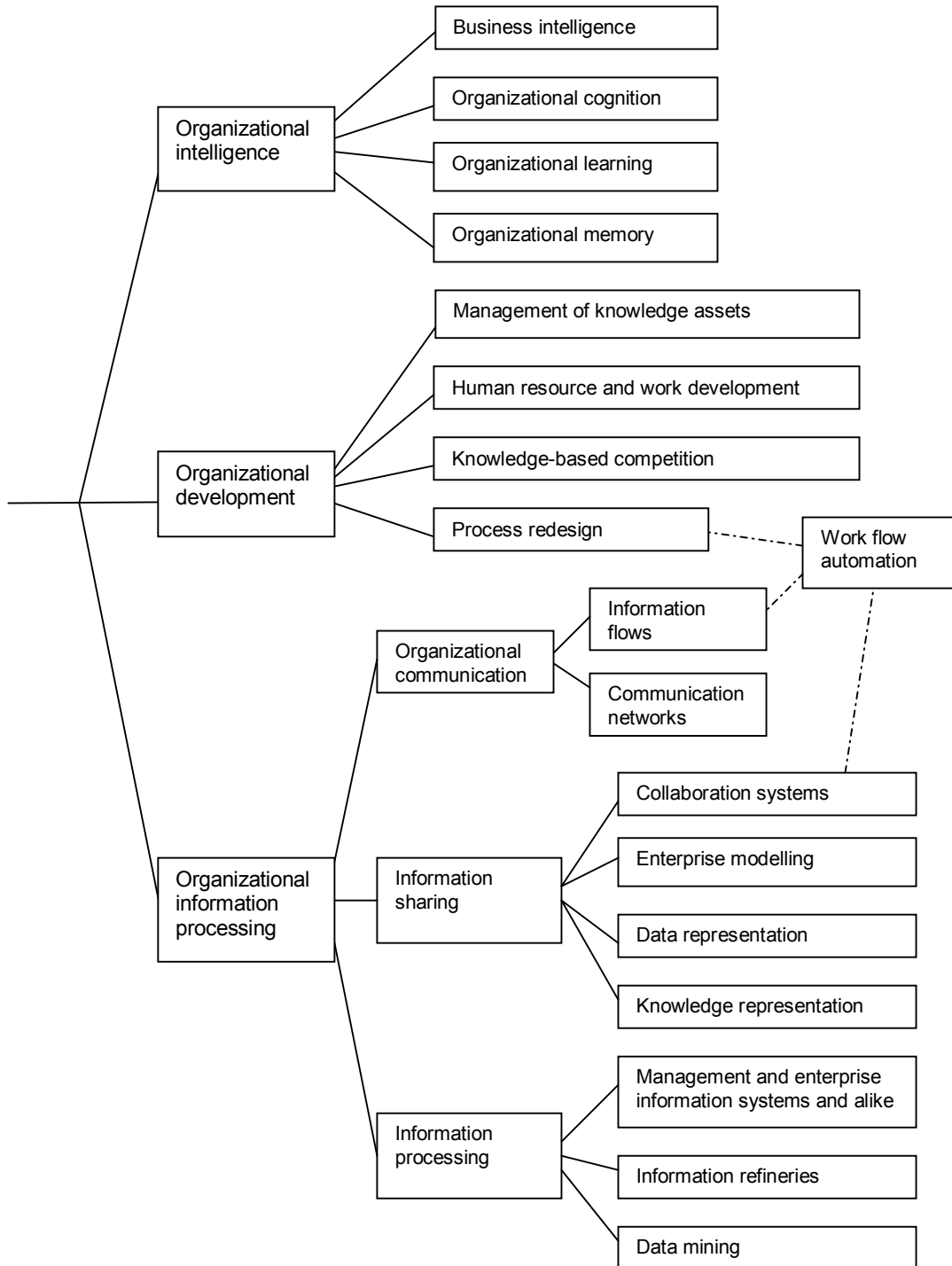
Figure 7. Disciplines of knowledge management
Source: Tuomi, 1999: 33

In most of the new 'isms' – after initial 'bluster' or 'roar', 'revolution turns into evolution'. Although knowledge management could still be called an emerging discipline, best practices in it are already documented and implemented. The effects of the recent developments in the labour market, in occupational structure and occupational practice have become increasingly visible in the 21st century. New methods of production and organization require new types of employee competencies. Problem-solving and social-communicative skills become more and more important. Educational expansion and occupational upgrading trends as well as – in line with globalization – heavy cyclical changes in economic conditions have also placed new demands on both employers and employees. They have become better aware of knowledge management as a discipline, not only a set of problems. (Melkas and Uotila, 2003.)

Knowledge management can be conceptually approached from three different directions:

- the first emphasizes organizational cognition and intelligence,
- the second organizational development and strategy,
- the third organizational information systems in information processing.

Further on organizational development, within the human resource development literature, the focus has been on two areas. Firstly, development of skills and competencies as well as systems for their management have received much attention. Secondly, development of knowledge-based work – including development of teamwork, organizational culture and work practices that support innovation – has been seen as a key to organizational success. Isolated knowledge management initiatives lead to failures in management, and people are starting to understand that knowledge management is about time management and about trust management. (Tuomi, 1999.)

Knowledge management, therefore, needs to address organizational knowledge from several different directions:

- management of knowledge resources (skills, competence and expertise),
- management of knowledge as it constrains and enables social activity and praxis,

- management of actual articulated knowledge products (product designs, documents) and more fundamental organizational assets (identity, language, system of motives),
- management of the balance between organizational stability and change (Tuomi, 1999: 300).

Knowledge management thus involves much more than the development and deployment of new information technology based knowledge management systems. Nonaka and Teece (2001: 1) begin a recent book by emphasizing strongly that it is "a book about knowledge management, not simply information management". They also note that in the old economy, the challenge inside the firm was to coordinate the physical items produced by different employees, but in the knowledge economy, the challenge is to build, combine and integrate the knowledge assets of even many thousands of individuals.

Scharmer (2001) describes the historical evolution of the discussion of knowledge management:

- During phase I, the primary focus was on explicit knowledge. Knowledge management revolved around information technology solutions, and it was seen as the processing of information.
- During phase II, the process of knowledge creation took precedence. Knowledge was conceived of as tacit and as a process (not a thing).
- During phase III, attention is focused on the thought conditions that allow processes and tacit knowledge to evolve in the first place.

What is described under phase I reflects the traditional view of information processing, which still dominates much of the discussion. It emphasizes the processing part without paying proper attention to the information part. The present dissertation is based on the conviction that one can concentrate on things other than information technology solutions when speaking of information and information management.

It has been argued that the mistrust between 'followers' of information management and 'followers' of knowledge management has its roots in 'the long tradition of Western management'. In this tradition, the organization has been viewed as an information-processing machine "that takes and processes information from the environment to solve a problem and adapts to the environment based on a given goal" (Nonaka, Toyama and Konno, 2001: 13).

Takeuchi (2001) also emphasizes the substantial differences in how knowledge is seen and handled in companies in different areas around the world. European companies have been primarily concerned with measuring knowledge. They have taken the lead in developing measurement systems for their intangible assets and reporting the results publicly. American companies have been much more focused on managing knowledge effectively by using information technology. The best practices in service industries – where knowledge is effectively the product – come mostly from American management consulting firms and manufacturing companies. (Takeuchi, 2001.)

Takeuchi (2001) thus argues that the focus in the West is not on knowledge *per se*. In Japan, companies are not convinced about the value of simply measuring and managing the already existing knowledge in a mechanical and systematic manner. They doubt if that alone will enhance innovation. Their focus is on creating new knowledge organizationally. At least three fundamental differences separate the Japanese approach to knowledge from the Western approach:

- According to the Japanese approach, knowledge involves emotions, values and hunches; it is not simply data or information that can be stored in computers.
- Rather than just managing knowledge, companies should be creating new knowledge.
- Everyone in the organization is involved in creating organizational knowledge, with middle managers serving as key knowledge engineers. (Takeuchi, 2001.)

The distinction between explicit knowledge (that can be expressed in numbers and words and shared in the form of data, scientific formulae, et cetera) and tacit knowledge (highly personal and hard to formalize, making it difficult to communicate or share with others) is, according to Takeuchi (2001), the key to understanding the differences between the Western approach to knowledge (knowledge management) and the Japanese approach to knowledge (knowledge creation; see also Figure 8). The West has placed a strong emphasis on explicit knowledge and Japan on tacit knowledge.

It seems that the strong Japanese emphasis on tacit knowledge should be seen against – and as a result of – the special characteristics of the extremely homogeneous Japanese society and work life. It is likely easier to understand tacit knowledge in an environment where homogeneity is

constantly emphasized – among the whole nation or among smaller groups of people – and there is a strong social hierarchy that is more or less impossible to bypass. (Uotila and Melkas, 2003.)

Nonaka, Toyama and Konno (2001: 14–15) argue in their theory of the organizational knowledge-creating process that knowledge is created in a spiral that goes through pairs of seemingly antithetical concepts (Figure 8). Apart from the pairs mentioned in Figure 8, other pairs can be part and whole, self and other, deduction and induction as well as creativity and control. These contradictions have to be transcended and integrated. The dynamic nature of knowledge creation has to be understood, and the knowledge spiral has to be managed. Knowledge emerges naturally in a suitable context.

Knowledge

Chaos	Order
Micro	Macro
Tacit	Explicit
Body	Mind
Emotion	Logic
Action	Cognition
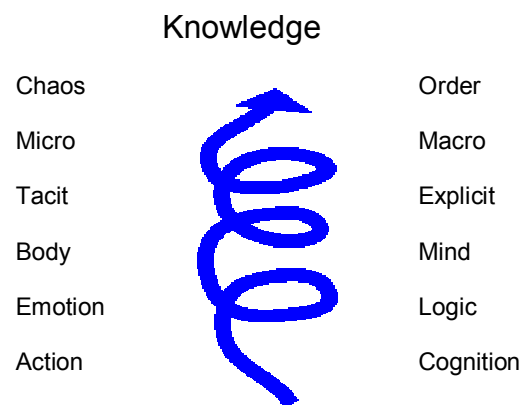
Figure 8. Knowledge created through a spiral
Source: Reproduced by permission of Sage Publications Ltd, London, Thousand Oaks and New Delhi, from Nonaka, Toyama and Konno, "SECI, ba and leadership: A unified model of dynamic knowledge creation", © Nonaka, Toyama and Konno, 2001 (p. 15)

It is, on the other hand, sometimes claimed that knowledge cannot be managed (e.g., Scharmer, 2001). Databanks can be managed, but human experience cannot. A counterargument to this is that it is possible – to a certain extent – to manage one's own human experience by managing one's reactions and actions. That, however, has to do with the individual level, which is not the focus of the present dissertation.

Emphasis on the cognitive dimension of knowledge gives rise to a wholly different view of organization. Once the importance of tacit knowledge is realized, one begins to think about innovation in a wholly new way. Unlike information, knowledge is about commitment and beliefs. It is a function of a particular stance, perspective or intention, and creation of new knowledge is as much about ideals as it is about ideas – and that fact fuels innovation. (Takeuchi, 2001.)

It is, indeed, interesting how determined particularly the Japanese advocates of knowledge management have been to 'devalue' information – and how far their thinking seems to be from the perspective of advocates of quality information, who are also concerned about creating organizational knowledge (cf. Huang, Lee and Wang, 1999).

Within knowledge management, a clear distinction is traditionally made between explicit and tacit knowledge. They are not totally independent of each other – rather, they are mutually complementary. Their interaction gives rise to four modes of knowledge conversion (Nonaka and Takeuchi, 1995; Takeuchi, 2001):

- from tacit to tacit knowledge (socialization),
- from tacit to explicit knowledge (externalization),
- from explicit to explicit knowledge (combination),
- from explicit to tacit knowledge (internalization).

Organizational knowledge creation ought to be understood as a process that 'organizationally' amplifies the knowledge created by individuals and crystallizes it as part of the knowledge network of the organization. Creating new knowledge is 'everybody's business' in the organization. Front-line employees are immersed in the day-to-day details of particular technology, products or markets. Top management provides a sense of direction for where the company should be headed, and middle managers serve as a bridge between the visionary ideals of the top and the chaotic 'reality' of those on the front line of business. Middle managers mediate between the 'what ought to be' mindset of the top and the 'what is' mindset of the front-line employees by creating middle-level business and product concepts. (Takeuchi, 2001.)

With regard to network environments, the situation is interesting. Also in networks, creation of new knowledge should obviously be everybody's business. However, there are no middle managers to act as mediators. This is the case in, at least, multi-actor service networks such as those

investigated in the present dissertation. Contacts often take place between employees so that managers or supervisors are not even aware of them. In some other kinds of networks, there may be mediators, but their role is likely to be even more demanding than the role of middle managers in individual organizations.

Self-transcending knowledge

Scharmer (2001: 68-69) introduced the concept of 'self-transcending' knowledge, or 'tacit knowledge prior to its embodiment'. It is the ability to sense the presence of potential, to see what does not yet exist. Scharmer cites Michelangelo, who, talking about his sculpture of David, said: "David was already in the stone. I just took away everything that wasn't David". The ability to see a David where others just see rock is the essence. Today's leaders also are faced with the challenge of figuring out what in their environment may contain the potential new "David". They also have to figure out how to take away everything that isn't David. Scharmer argues that the knowledge management discussion of the next decade will revolve around the interplay of the three forms of knowledge: explicit, tacit and self-transcending. (Scharmer, 2001.)

Explicit knowledge

Tacit knowledge (embodied)

Self-transcending knowledge (not yet embodied)
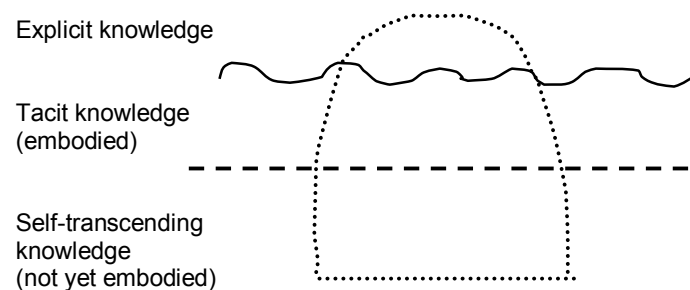
Figure 9. The three forms of knowledge
> *Source: Reproduced by permission of Sage Publications Ltd, London, Thousand Oaks and New Delhi, from Scharmer, "Self-transcending knowledge: Organizing around emerging realities", © Scharmer, 2001 (p. 70)*

Figure 9 depicts the three forms of knowledge using the model of an iceberg drawn by Scharmer. Above the waterline is explicit knowledge. Below the waterline are the two types of tacit knowledge. Self-

transcending knowledge is neither outside nor inside the knower. It emerges from a *basho* – a field or a shared space that gives rise to the process of enacting tacit knowledge in the first place (Scharmer, 2001: 76).

The different types of knowledge are further described with examples from quality management. When measuring the outcomes of quality, managers need explicit knowledge. When improving process management, the overall focus is on knowledge in use – tacit knowledge. When improving qualities of thought and customer experience, self-transcending knowledge is needed. (Scharmer, 2001: 70.) It is a relevant concept also within safety telephone service networks of the present dissertation.

Knowledge management: A fad?

Although knowledge management offers a compelling promise, some observers have declared that knowledge management is a fad that does not produce results. A survey conducted in 108 companies in 1998 concluded that no correlation was found between systematic management of knowledge and improved bottom-line performance (Lucier and Torsilieri, 2001). The researchers expected to find a reasonably strong relationship, but finally realized that the negative result was accurate.

Lucier and Torsilieri (2001) claim that results have been limited because the knowledge management community misreads the promise. Knowledge must be integrated into management – not the other way around. Three lessons from results-driven programmes illustrate the integration of knowledge with management:

- Many traditional management practices remain valid: driving only one or two priorities at a time, selecting priorities that have a strategic impact and measuring results. To achieve significant results, the new knowledge management disciplines must be synthesized with many traditional management practices.
- We must be more explicit about the link between the improved creation and use of knowledge, on the one hand, and the benefit to customers and shareholders, on the other hand.
- We have to embrace a new view of change. Change cannot drive results – results drive change with knowledge management.

> Unfortunately, many managers try the sequential approach; they create knowledge first and then try to figure out how to get people to use it.

The above list could be rewritten to concern information – to reflect thinking of information management from the point of view of information quality. For instance, the second point would then emphasize the link between the improved creation and use of information and the benefit to customers (which can be understood as covering network collaboration partners as well). The first point would also be closely related to the approach of the present dissertation. It is argued that information flows and information quality are priorities that have a strategic impact within safety telephone service networks. However, they cannot be managed in a vacuum. This discipline has to be combined with network management and knowledge management.

Lucier and Torsilieri (2001) predict that in the future, two fundamentally different schools of thought will evolve within knowledge management: (i) sharing-enabled knowledge management and (ii) results-driven knowledge management. Those who adhere to the sharing-enabled school will continue to argue that broad sharing initiatives can stimulate creativity, drive performance improvement and create competitive advantage. The results-driven practitioners will increasingly disassociate themselves from the term 'knowledge management'. They focus on achieving significantly improved results by integrating knowledge into management. They ask, for instance, "What do my employees need to know to make the best decision?" instead of asking, "What is the best way for my employees to get the job done?". (Lucier and Torsilieri, 2001.)

As differences between these two schools of thought increase, this will add to the already high levels of confusion among people trying to manage in the knowledge age. Companies, not understanding that there is a choice, are increasingly launching knowledge management programmes that lead to no results, disappointment, mass confusion and disillusionment with the promise of knowledge management. Such dangers need to be recognized and thinking redirected. (Lucier and Torsilieri, 2001.)

A new era of knowledge management

One way to redirect thinking is the way in which the present dissertation is built. Information quality is very much related to, for instance, the above question "What do my employees need to know to make the best decision?". However, perhaps due to prejudice between disciplines and other reasons, knowledge management programmes and considerations have not been combined with considerations of information and information quality. It seems essential that knowledge management programmes of the future are combined with management of information quality – otherwise their foundation remains incomplete (cf. Huang, Lee and Wang, 1999). This central argument justifies the lengthy review of recent knowledge management literature. It is an argument for the future. In the analysis of the present dissertation, knowledge management programmes and considerations are not investigated – they do not exist for the kinds of network environments that are studied here.

Takeuchi (2001) claims that knowledge management is now moving into a new era. European companies are beginning to move beyond measuring knowledge and looking for ways to better apply knowledge to work. American companies are beginning to realize the limitations of the information technology driven approach and incorporating the human factor into knowledge management. Japanese companies, on the other hand, are beginning to move beyond the tacit dimension of knowledge and exploring how databases can improve productivity. Takeuchi argues that the tacit dimension of knowledge, which was largely ignored in the West, holds the key to whether or not knowledge management will end up just a fad. The signs are encouraging, since companies are starting to realize that explicit knowledge simply represents the tip of the iceberg. (Takeuchi, 2001.)[2]

Knowledge management discussion has focused overwhelmingly on companies. Although explicit knowledge – information – represents only part of the iceberg, it is argued that this tip is the place to start within, for instance, service networks such as those investigated in the present dissertation. Later, depending on the case, knowledge-related

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[2] Takeuchi's arguments make one wonder about the necessity and usefulness of emphasizing the differences in management approaches between 'the West' (which is not a particularly homogeneous block) and Japan without paying attention to the Japanese society, way of thinking, etc., as a whole. Solutions that are successful in Japan are unlikely to be importable as such to other countries – differences in 'mental environments' are large. (Uotila and Melkas, 2003.)

approaches may be possible. There is likely to be a lot of tacit and self-transcending knowledge in safety telephone service networks, but the foundation must be laid first by studying information quality, to contribute to knowledge creation in one important way.

3.4   Organizational communication

3.4.1   Perspectives on organizational designs

Whichever starting point is taken, information management or knowledge management, or a combination of these, organizational communication forms an essential part of the theoretical background. In organizations, information, knowledge and productive processes are inherently interrelated. Organizational information processing can also be understood as including those research traditions that have emphasized organizational communication (Tuomi, 1999) – and vice versa.

Table 1 lists four common perspectives on organizations (for further discussions – that are beyond the scope of the present dissertation – see, for instance, Aula, 1999; Åberg, 1989; 2000; Wiio, 1992; Stacey, 1991). The similarities between all the perspectives are clear, although different words are used and the various elements have different weights. The present dissertation touches upon all the perspectives:

- from the economic perspective: network of value creation and transactions,
- from the administrative perspective: information processing, management and control,
- from the social perspective: all the elements listed in Table 1 except power,
- from the activity perspective: all the elements listed in Table 1.

*Table 1. **Four common perspectives on organizations***
Source: Tuomi, 1999: 224

Perspective	Elements
Economic	worker as seller of labour; owner; business system; company in competition; network of value creation and transactions
Administrative	management and control; design of strategy and structure; effective distribution of labour; information processing
Social	communication and collaboration; power; trust; institutions; organizational culture
Activity	business process; work process; task coordination and scheduling

Table 2 summarizes various approaches that have been used to explain and understand organizational knowledge processing, starting from the traditional information processing view – probably the most influential view among organizational theorists during the last three decades. This is followed by research on organizational cognition, a communicative view of organizations, a social systems view and a view of organizations that links social communities and meaning processing. The view of organizations as communicative commitments is regarded as being closest to the approach of the present dissertation.

Each of the alternative conceptualisations used to describe organizational phenomena and information processing opens new avenues for thought and action, as it makes visible some aspects of organizations that are hidden by the conceptual structure of other views. In practical organizational life, the various units of analysis that underlie organizational meaning processing and knowledge generation need to be understood and managed. (Tuomi, 1999: 280.)

Table 2. Summary of discussion on organizational designs for knowledge generation
Source: Adapted from Tuomi, 1999: 233-281

Organizations as information processors	The success of organizations depends on their capabilities to process information. Organizational information processing capacity consists essentially of logistics of information flow and the capacity to interpret that information. Tuomi argues that the hierarchy of data-information-knowledge should be turned the other way around. Data emerges last, only after there is knowledge and information available. The traditional information processing view is becoming increasingly incompatible with prevailing forms of organizational life (particularly knowledge intensive organizations).
Organizational cognition	A necessary extension to the traditional information processing view. By processing information, organizations try to reduce organizational uncertainty and ambiguity. Information about organizational environment is not usable as such; it has to be interpreted by organizational actors. These interpretations are based on individual cognitive processes. There are important differences in the characteristics of various information media as well as in their temporal qualities. This approach has also led to practical suggestions on creating shared conceptual models for strategic management. Information processing is replaced by the explicitly cognitive construct of sensemaking (according to Weick, 1995) – the process that constructs the world in which a social actor lives. Sensemaking is grounded in identity construction; it is retrospective, enactive, social, ongoing, focused on external cues and driven by plausibility.[3]
Organizations as communicative commitments	The main task of an executive is that of communication. A pragmatic view on information; emphasizes organizational coordination and management as rhetoric. Communication is a tool to get things done and a method of interaction between human beings. Formal organizational structure becomes a relatively minor aspect of possible communicative structures that directly influence organizational information processing. A horizontal (rather than vertical) view on organizational processes and networks becomes interesting. Micro-level questions of appropriate structures for communicative interactions and message flows.

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[3] Tuomi (1999: 244) notes that much of the explicit organizational cognition research has been limited to managerial cognition and top-management teams, with the underlying assumption that at lower levels, participants in interpretation and other phases of strategic decision making are neither informed of issues pertaining to the whole organization nor involved in their resolution. Tuomi has not commented on this. It has been confirmed in many studies that to obtain shared values and a common organizational goal, all employees should be informed of issues pertaining to a whole organization and even feel entitled to express views of their resolution.

Organizations as reproduced structures	The interpretation of communication depends on social structures that establish themselves in reproduced action. The structuration theory of Giddens (1984) focuses on underlying institutional structures that act as a communicative background in any specific organization. The structuration theory comes close to earlier authors, such as Durkheim (1964), Leontjev (1978) and Bourdieu (1977); knowledge has a central role in coordinating activities within a social system. Within the structuration theory, 'structures' are dynamic entities produced by rules, resources and intelligent agents. They are integrated and interdependent systems of sensemaking, resource mobilization capabilities and norms. Organization is held together by the continuous flow of action that reproduces its structures. Organizational structure is not a 'constraint' that would only limit possibilities of action. All organizational constraints are simultaneously limiting and enabling.
Organizations as autopoietic systems	The autopoietic theory reveals that many assumptions made by the traditional information processing view are either implausible or misleading in existing organizational environments. The metaphora of communication as transmission of something between the ends of a communication channel is basically false. The phenomenon of communication does not depend on what is transmitted, but on what happens to the person who receives it (Maturana and Varela, 1988). Central concepts are adaptation and organizational fit. Structural couplings are, again, systems in which organizations, for example, interact with other organizations or with societies where they are embedded.
Organizations as fractal communities	Organizations have a multitude of units of analysis that need to be taken into account. The units of analysis may be divided into bounded (autonomous entities that are agents for action) and open (extended and unbounded, with fuzzy boundaries). Organizations are seen as communities of communities that constantly renew and learn their capabilities as well as recreate their stocks of knowledge. The development of knowledge is a social phenomenon, and knowing, thinking and knowledge creation are not something that an individual does or can do. Knowing and knowledge creation are processes that occur in 'thought collectives' (Fleck, 1979). The focal unit of organizational learning is a dynamic interaction space (*ba*) where new knowledge emerges (Nonaka and Konno, 1998). A community of practice should be seen as part of a larger system of activity. A system of activity is a system where the subject, object and community are closely interrelated (Engeström, 1987). The basic internal contradiction of human activity is its dual existence as the total societal production and as one specific production among many. The contradictions inherent in all activity produce both needs and opportunities for overcoming these contradictions, thus pushing the social system into a mode of expansive learning.

3.4.2   **Organizational communication perspectives**

The numerous ways of organizing and describing organizational communication perspectives have been tied with prevailing organization theories. Different schools dominate chronological periods, and each school affects points of view to come. Aula (1999: 22) defines organizational communication as follows: "Communication is a process that takes place in a certain organizational context and in which people together, through messages, create, maintain, process and work on meanings." Interaction in organizations clearly has two dimensions: mutual communication and organizational communication. (Aula, 1999.)

Åberg (2000: 97) lists different ways in which organizational communication has been modelled. There are so many – from process models to chaos models to function models – that they cannot be discussed in this chapter. Many of them would be interesting with regard to the present dissertation, such as system models. As the focus in this dissertation is on information quality and not on the vast field of communication, the choice was made to go through only selected perspectives from various theories that contribute to the information quality considerations.

Aula (1999: 91) notes that most models that describe the communication process are linear and predictable, more rational than the human-being her/himself. Aula adds that although the main function of the models is forecasting, the ability of traditional communication models with boxes and arrows to explain or predict the processes they describe is not very good.

A distinctive characteristic of discussions on communication is that the borders between disciplines seem to be so high that, for instance, literature on organizational communication does not include the same references as literature on knowledge management, and vice versa. Communication theories and studies are hardly cited in literature on knowledge management, although communication theories have a much longer history.

Three organizational communication perspectives are those related to communication functions: production, maintenance and innovation functions (Farace, Monge and Russell, 1977). Organizational communication can also be seen from a three-fold perspective containing action, relationships and choice. Action means that organizations must

focus on action, and communication plays a pivotal role there. Communication may even be seen as the foundation for most organizational action, and organizations are seen as collections of communicative acts. This perspective helps to identify the goals of communication insofar as they relate to different types of action, while it also helps to define effective versus poor communication. Relationships mean that organizations may be described as entities engaged in social, as well as economic, exchange. They cannot exist without social communication. Choice, again, means that a communicator will generally choose how to communicate. (Weick, 1979.)

According to Luhmann (1995), communication is based on active management of the differences of understanding, information and utterance. For communication to emerge, there has to be an expectation of communication and a belief that the communicator tries to manage the difference between information and utterance. The requirement for communication is only that the receiver is able to observe a difference between information and utterance. (Luhmann, 1995.)

Maturana and Varela (1988), again, distinguish two forms of communication:

- simple communication – mutually coordinated behaviours within an evolved structural coupling,
- languaging – self-referential coordination that is based on these mutual coordinations.

Most of the time, communication takes place against a shared background of meaning – that is, conventional selections of the phenomena of the world.

According to Luhmann (1995), every meaning proposition that is uttered enables the receiver to negate it. The defining characteristic of a communicative event is that it changes the state of the receiver. Both acceptance and rejection are possible for all communicated meaning but only after communication has already occurred. Luhmann further proposes that there is a functionally distinct difference that makes it possible for communication to become a process: the difference between themes and contributions.

However, contrary to what was argued by Luhmann, it appears that acceptance and rejection are possible to a certain extent even before

communication has occurred. A situation is possible where, for instance, the receiver has such strong prejudice against the sender that the receiver is practically unable to receive the communication in the first place.

Communication complexity results from the use of limited resources to ensure successful communication under problematic and uncertain conditions. It grows as the demands of the communication process on mental resources approach their capacity. The sources of communication complexity can be categorized as cognitive, dynamic and affective complexity. High levels of communication complexity can lead to communication failures. Overcoming high complexity is thus central to successful communication. Extremely low levels of complexity may, however, reduce performance by failing to arouse sufficient attention. (Rasmussen, 1986.)

Cognitive complexity is a function of (i) the intensity of information exchanged (interdependency) between communicators, which increases the probability of misunderstanding, (ii) the multiplicity of views held by the communicators, which increases the plausibility of understanding the message in a different context than intended and (iii) the incompatibility between representation and use of information, which requires the information communicated to be translated before it can be used as well as increases the demands on resources and the probability of error. (Straus and McGrath, 1994; cf. Boland, Tenkasi and Te'eni, 1994.)

Dynamic complexity refers to the extent to which the communication process depends on time delays, multiple unclear or deficient feedback processes and changes during the communication process. Dynamic complexity increases the likelihood of misunderstanding the required action. Affective complexity, again, refers to how far communication is sensitive to attitudes or changes in disposition towards the communication partner or the subject matter. Mistrust may be one such obstacle. (Diehl and Sterman, 1995; Salazar, 1995.)

By analysing a message, its communicative impact can be assessed to the extent that the sender's intent has been understood and accepted once the message has been received. Habermas (1984) claims that for a communicative act to take place (i) the act must be comprehensible so that the receiver can understand the sender; (ii) the act must be true so that the receiver can share the sender's knowledge; (iii) intentions must be expressed truthfully so that the receiver can trust the sender and (iv)

the act must be appropriate within some normative context so that the receiver can agree with the sender within this value system.

Successful communication leads to mutual understanding and relationship between the sender and the receiver. Mutual understanding does not include only the receiver's understanding of the message, but also the sender's awareness that the recipient of the message has understood it. Relationship refers to the conditions of trustworthiness and appropriateness within the communicative act. (Habermas, 1984.) The relative importance of these two closely interrelated aspects may depend on the precise communication goal. Relationships build trust – the confidence that the receiver will fulfil obligations and behave in a fair and predictable manner. Communication is therefore more effective when trust and commitment are high. (Cf. Roberts, 2000.)

Habermas (1984) discusses four basic social processes that require communication: (i) reaching understanding, (ii) coordinating action, (iii) building relationships (socialization) and (iv) strategically influencing others. Empirically derived classifications of organizational communication goals also exist (e.g., Carlson and Davis, 1998; Åberg, 2000). Other useful perspectives to the communication process are:

- Contextualization: provision of explicit context in the message. It is necessary for the sender to build an explicit interpretation of the issue in order to improve problem-solving performance. (Kintsch, 1988.)
- Affectivity: inclusion of affective message components that describe emotions and moods, not necessarily pleasant ones (Schwarz, 1990).
- Control: a matter of overseeing and, if necessary, adjusting the communication process to assure effective communication. It may be done by (i) planning the pattern of communication ahead of the process (who does what in the communication process; making a distinction between plan and implementation) or (ii) testing and adjusting based on feedback during the process. In planned control, message redundancy – especially repetition of key ideas – is utilized to ensure successful communication. (Mayer, 1985.)
- Perspective taking: the sender actively considers the receiver's point of view – what the partner sees and hears of the message. The receiver's views and attitudes may be targets of the communication or left outside of its scope. This concerns both cognitive and affective aspects of the receiver's perspective.

Krauss and Fussell (1991) argue that perspective taking is necessary for the communication to be comprehensible.

- Attention focusing: the sender attempts to direct or even manipulate the receiver's processing of the message (Simons, 1991).

Contextualization, control and perpective taking are of special interest for the present dissertation. Affectivity and attention focusing, again, do not appear to be relevant in the environment of this dissertation. Daft and Lengel (1984) argue that a message is liable to be misunderstood most frequently when cognitive complexity is high, for example in non-routine situations involving a complex exchange of views. Contextualization is necessary in these situations. Within service networks such as those investigated in the present dissertation, especially large ones, cognitive complexity appears to be high – as are the other two types of communication complexity.

Control is required when a given situation is perceived to be complex and when the probability of communication error is high. Within safety telephone services, particularly control through planning seems crucial. It appears to be closely related to information quality considerations.

The choice of medium according to communication strategies is important. In the context of networks such as those investigated in the present dissertation, however, this does not seem to be a major issue. Mainly adaptiveness – the potential to personalize a message to a particular receiver (Daft and Lengel, 1984) – could be taken into account. Message form has to do with the message's size, distribution, degree of organization (the extent to which the message is systematically ordered to support mutual understanding) and degree of formality (interactive closure towards some organizationally accepted representation of action). Traditionally, message form has received less research attention than the choice of medium. This seems to be in line with the attention given to information content and quality versus information systems.

Message size and distribution have been popular measures of communication. Message size is a function of the number of semantic units, such as words or sentences. Distribution is the number of destinations to which the message is sent. (Daft and Lengel, 1986.) In the present dissertation, the degree of message organization is more relevant than size, distribution and message formality. In this dissertation, relevant characteristics of a highly organized message are, for instance, a clear

allocation of tasks between the sender and the receiver as well as a familiar or standard format for immediate recognition.

Organizational tasks have been classified according to the dimensions of task analysability, task variety and task temporality (Daft and Lengel, 1986). The task perspective to organizational communication is related to the information communicated as a response to uncertainty. Uncertainty, again, is the difference between the amount of information required for performing the task and the amount of information already possessed by the organization (Galbraith, 1977).

The task perspective and the concept of uncertainty seem to have linkages to information quality considerations. For instance, low task analysability (the ability to define the procedure needed to complete a task) increases the probability of misunderstanding how to proceed with action. It also results in the need for richer information. (Daft and Lengel, 1984; 1986.) This seems to be the case within the networks chosen for the present dissertation. Task temporality (related to the time during which the task must be completed), again, is high in safety telephone services, which affects – increases – requirements for communication. Tasks related to alarm calls have to be completed without delays.

Individual characteristics introduce variations in the communication process. They may sometimes be ignored when communication is analysed. Psychological distance may exist regardless of the physical distance. A sender-receiver affective distance, again, is the initial negative relationship between the sender and the receiver before transmitting the message. It is beyond the scope of the present dissertation to analyse individual characteristics, but it is expected that the interview data may provide some ideas concerning the existence of psychological distance. Physical distance is an essential characteristic of the large networks to be investigated.

The distance between the sender and the receiver changes both goal priorities and considerations of compatibility and profitability. The effects of physical distance are partly dependent on the advances in communication technology. The present dissertation, however, is based on the conviction that technology is just one factor – and there are more important ones to be studied in multi-actor service networks.

Differences or distances between sender-receiver worldviews, values, languages and other common factors pertinent to information processing

have been found to increase cognitive complexity of the communication and to lower the plausibility of mutual understanding. A greater cognitive distance may also be associated with higher uncertainty about what the receiver knows – and, therefore, higher cognitive complexity (Kraut and Higgins, 1984). When the communication diverges from mutual understanding, a shared context needs to be created (Krauss and Fussell, 1991).

Affective distance may imply lack of trust between communicators. Low trust reduces the likelihood of information exchange (Williamson, 1975; cf. Roberts, 2000; Åberg, 2000). Cognitive distance coupled with low trust reduces the likelihood of information exchange where it is most needed in order to build trust. The concepts related to distance are central in the present dissertation. It could be expected that, for instance, physical distance in combination with the high heterogeneity of actors in the networks to be investigated lead to many challenges in the transfer and quality of information. The results will show whether this is the case – and if so, how the challenges are being met.

Organizational communication is becoming increasingly complex and more intensive, and it is supported more and more frequently by information technology (cf. Åberg, 2000). Communication is a resource for organizations that – when utilized properly – should enable them to cope with increasing complexity in their environments (cf. Åberg, 2000; Ståhle and Grönroos, 1999). New forms of organization – such as those based on virtualization – require new ideas and new forms of communication as well. Trust is crucial in these new forms of organization.

Åberg (2000: 222–223) writes on network communication between work organizations. Sufficient and efficient communication is a basic prerequisite for ensuring undisturbed actions. Collaboration between work organizations is hampered by the very natural fact that decision-making takes place outside of one's own control. Subcontractors and alike decide about their actions themselves, and the most important control factor is continuation of the subcontracting relation. The present dissertation addresses an area that is argued to be even more complicated in this sense than industrial subcontracting.

Åberg (2000) also notes that compatibility problems have increased. In network communication, information transfer usually has to be adapted to the systems of the party that is using the oldest or the most undeveloped information systems. This is clearly the case in the networks to be

investigated in the present dissertation. In some organizations, there are practically no information systems to combine. These organizations are still able to function as parts of multi-actor networks. This highlights, again, the fact that 'conventional' methods of investigation are not well suited to the case environment of this dissertation.

Theories on organizational communication offer many essential insights into the topic of the present dissertation. Information quality cannot be analysed in a vacuum, but it is intertwined with communication principles and practices. This dissertation is directed towards analysing and understanding the ways in which organizations and individuals in them act in relation to information. Such knowledge is essential in improving and managing communication processes, as well.

3.5   Network management: Virtual organization and virtual teams

Nohria and Eccles (1992) as well as Baker (1992), among others, have argued that all organizations can be seen as networks, as the term 'network' means the structure of ties among the actors in a social system. In the present dissertation, network is defined as "a fluid, flexible and dense pattern of working relationships that cut across various intra- and interorganizational boundaries" (Nohria and Eccles, 1992: 289). In this dissertation, the concepts of network and networking primarily refer to heterogeneous, multi-actor, multi-sectoral, multi-professional networks based on virtualization – not the more usual corporate arrangements.

Virtualization, again, implies "the vanishing of the formal and spatial boundaries of firms" (Kotorov, 2001: 55). It is here understood from a somewhat wider perspective covering – not only firms – but also other organizations providing services (from the public sector, non-governmental organizations, foundations and cooperatives). A related, more general definition has been given by Handy (1995: 44): "Virtuality … [means] without a place as its home. Virtuality requires trust to make it work."

Virtual teams have been defined in various ways, including by Townsend, DeMarie and Hendrickson (1998: 17) as "composed of coworkers geographically and organizationally linked through telecommunications and information technologies attempting to achieve an organizational task". Global virtual teams, again, have been defined as follows: "A global

virtual team is an example of a new organization form, where a *temporary team* is assembled on an as-needed basis for the duration of a task, and staffed by members from the far corners of the world" (Jarvenpaa, Knoll and Leidner, 1998: 30).

The concept of virtual organization was brought into existence by developments in computer networks. It is claimed that it has no agreed meaning (Kotorov, 2001). Gil-Estallo et al. (2000: 242) have a general view: a virtual organization is one to which different people contribute, from the strategic apex to the operational level, but not necessarily in a coincident way with regard to time or space.

Virtual firms have been defined by Teece (1996: 123) as follows: "[…] they will possess a change culture upon which there is great consensus. They will have shallow hierarchies and significant local autonomy. Such firms will resist the hierarchical accoutrements of seniority and rank […] and they will resist functional specialization which restricts the flow of ideas and destroys the sense of commonality and purpose." Ståhle and Grönroos (1999: 70) define virtual firms simply as those that "combine their skills, and build services, projects and products so that these are produced simultaneously by several firms". A related concept is virtual enterprise (e.g., Katzy and Dissel, 2001).

Virtual organization has increased the possibility of decentralized control, which is why more spatial decentralization is found. It is possible to have spatial decentralization without having hierarchical decentralization. (Kotorov, 2001.) In the present dissertation, the concept of virtual network is used, because it is regarded as representative of the variety of actors and organizations in the structure in question. Virtual organization has primarily been used in the context of companies. Virtual team, again, is not a very appropriate concept, because teamwork is perceived to be of temporary, task-specific nature. Its use has, in practice, widened to cover even permanent structures, but due to its original meaning, it is not regarded as suitable for the present dissertation. The networks investigated in this dissertation are based on continuous operations.

Earlier studies on virtual teams provide an interesting background for this dissertation, however. It is argued that differences in sectoral, organizational and professional backgrounds – as in the networks of this dissertation – could be compared with regard to their effect to differences within global virtual teams: diverse ethnic, national and organizational backgrounds (cf. Kayworth and Leidner, 2002: 10). It is probably not very

far-fetched to expect that similarities in, for instance, professional and organizational backgrounds (concerning the type of organization, for instance, universities or multinational corporations – which have been focused on in studies of global virtual teams) may outweigh diverse ethnic and national backgrounds (cf. Jarvenpaa and Leidner, 1999). On the contrary, in multi-sectoral, multi-organizational, multi-professional virtual networks – such as those investigated in the present dissertation – it may be only nationality that represents similarity.

The differences in the use of new technologies may also be greater in the kinds of networks studied here than in global virtual teams. Townsend, DeMarie and Hendrickson (1998) have namely claimed that membership in virtual teams may be highly biased towards those individuals skilled at learning new technologies – and against those who experience 'technophobia'. Obviously, the above argument of the author will not be confirmed through this dissertation, but perhaps in future research, comparisons will be made.

Kayworth and Leidner (2002: 10) emphasize that due to challenges with communication, technology, logistics and culture, virtual team environments may be more complex than their traditional counterparts. Solomon (1995: 50) reminds: "The fundamentals of global team success aren't very different from the practices that work for domestic work teams. But there are more variables." He gives additional examples: cultural behaviour, expectations on the roles of communication, team leadership, group dynamics as well as logistics that have to do with different time zones, lots of travel and busy conflicting schedules. Again, it appears that within large national networks – such as the nation-wide network investigated in the present dissertation – all but one (different time zones) of the above factors exist (although it is not team work). The argument that differences may not be that large after all, is therefore repeated.

An interesting table by Kayworth and Leidner (2002: 10) summarizes challenges of virtual teams. Although these are partly clearly related to the global character of the teams investigated, the table is relevant for the present dissertation (see Table 3). In the context of this dissertation, cultures could be regarded as organizational cultures, and multiple time zones replaced by long distances in combination with busy work schedules and differences in staff resources.

Table 3. Challenges of virtual teams
Source: Kayworth and Leidner, 2002: 10 (Table 1)

Type of challenge	Description
Communications	Traditional social mechanisms are lost or distorted
	Communication dynamics such as facial expressions, vocal inflections, verbal cues and gestures are altered
	Distinctions among member's social and expert status lost or distorted
	Inhibition in building trust
	Communication process dysfunction
Culture	Potential for multiple cultures requires greater communication skills
	Unrealistic cultural expectations
	Communication may be distorted through cultural misunderstandings/ biases
Logistics	Multiple time zones make scheduling meetings as well as travel very difficult
Technology	Technophobia
	Need for proficiency across a wide range of technologies
	Team membership bias towards individuals skilled at learning new technologies

Alternative perspectives on networking may be divided into, for example, the economics-based perspective, the corporate strategy perspective and the interorganizational perspective. The economics-based perspective and the corporate strategy perspective are not well suited to the present dissertation. In the first, networks are examined in relation to their differential efficiency against the alternative ways of organizing intercorporate relationships (Viitanen, 1998: 35). The second presumes that senior managers rationally select a networking option and craft each relationship within that network to further the immediate interests of their corporations (Viitanen, 1998: 37). Within the networks investigated in the present dissertation, there are hardly any alternative ways or options, but the safety telephone service operations are essentially based on networking. The situation is complex due to multisectoral cooperation, contracts of purchase, private and public customers, et cetera.

The interorganizational perspective comes somewhat closer to what is investigated in the present dissertation. Networks are studied as

emerging sociological structures, the rationale of which comes from social and individual characteristics of human interaction in cooperative arrangements (Viitanen, 1998: 38). Advocates of this perspective have claimed that networking enables (i) an easy exchange of ideas, information and goods, (ii) accumulation of skills and innovative capability as well as (iii) development of a cultural homogeneity allowing cooperation, trust and consensus among participating actors (Grabher, 1993; Lei, 1997). That is a very positive view, but in light of the present dissertation, perhaps overly optimistic. Networking does not necessarily enable these advantages – that seems to be the case at least in the networks investigated in this dissertation.

Within the interorganizational perspective, networks have been seen as socially constructed action takers. They have a separate identity from their individual members, and network management needs to empower the network through separation of the operative network management from members' individual processes. (Osborn and Hagedoorn, 1997; Viitanen, 1998.) An organizational socialization process is necessary to balance the opposite pressures of autonomy and consensus. Institutionalization of the network requires conscious efforts in shared value creation and active relationship management towards mutual goals. (Viitanen, 1998: 39.)

The views concerning network identity and institutionalization as well as organizational socialization processes are interesting and important for the present dissertation. It is argued that information quality considerations – such as in this dissertation – can potentially contribute to the creation of network identity and to the socialization and institutionalization processes. Doz (1996: 64) notes that the learning cycles of successful networks cumulate over time, as members progressively improve the initial conditions for the cooperation and make increasingly irreversible commitments to mutually beneficial operations. If willingness to do all this occurs, it is likely that the scope, scale and efficiency of cooperative activities can be increased. An investigation of such learning cycles is beyond the scope of the present dissertation, but an analysis of them might be meaningful in the networks of this dissertation in a few years' time.

Ståhle and Grönroos (1999) discuss dynamic networks and their management. To them, a dynamic network is an entity with frantic pace, even of a chaotic nature, and it is difficult to discern where it starts and where it ends. Interfaces of the system with its environment are tight:

interest groups, customers, subcontractors and other collaboration partners belong closely to the system. From the middle of what seems to be chaos, new forms of operations and innovations are continuously born. The organization actually seems to be in seamless interaction with its environment and changes in it. (Ståhle and Grönroos, 1999: 67-68.)

Certain parts of the above description appear to be suited to the networks of this dissertation. However, Ståhle and Grönroos's (1999) general views of today's companies are also appropriate. "A company must be seen as a tridimensional system, in which its mechanistic, organic and chaotic characters have their own tasks in producing competitiveness. […] A good example of organic action aiming at controlled development is, for instance, quality management systems. Their aim is to guarantee both sufficient stability and foreseeability – and also continuous and controlled development." (p. 70.)

Increase in dynamics is also seen in companies' daily operations in line with increasing general pace of change in the environment. It is claimed that a bigger and bigger part of a company's operations is based on spontaneity and *ad hoc* decisions: good assessment of the situation and ability to react quickly. A modern company is like a hologram, in which all the three types of organization live simultaneously and form different operational environments inside of the company. Knowledge (or information, a necessary addition in the present dissertation) capital is composed differently in these operational fields – and its management occurs in different, even mutually contradictory ways in these fields. (Ståhle and Grönroos, 1999: 71.)

It appears that these views presented by Ståhle and Grönroos (1999) could be tentatively generalized to cover networks. Even networks – such as those investigated in this dissertation – could be seen as tridimensional. In virtual teams within a global company, there is perhaps no need for a mechanistic character, but in safety telephone service networks, all the three characters seem necessary. For instance, good assessment of the situation and *ad hoc* decisions are essential within these services. Information quality considerations, again, contribute to quality management (the organic character).

The remainder of this chapter concerns studies of virtual teams. Members of a virtual team usually work together only for the duration of the project, so they have no time to build relationships. In virtual networks, there may be other but very similar factors hindering relationship building – for

instance, lack of past and future relationships, the mediated communication environment and lack of face-to-face communication. Many researchers claim that face-to-face communication is needed in order to build trusting relationships (e.g., Handy, 1995).

Developing trust

Trust can be seen from a rational or social perspective, with the rational perspective being the most common in research. From the rational perspective, increases in trust decrease transaction costs of relationships, because individuals have to engage less in self-protective actions. The social perspective is based on moral duty – a social group has values regarding one's obligations to others. (Jarvenpaa, Knoll and Leidner, 1998: 30-31.)

In the present dissertation, trust is understood as both an institutional phenomenon and an interpersonal phenomenon. Trust is defined briefly as being based on the expectation that others will behave as expected and contribute in a positive way (Jarvenpaa, Knoll and Leidner, 1998: 31; van der Smagt, 2000). This concerns both the intentions and the necessary competencies of others (cf. van der Smagt, 2000: 153). 'Others' is here understood as referring to both individuals and organizations within networks. There is also a separate concept, 'collective trust' – for trust in a group, team or organizational unit. It is more complicated than dyadic trust between a trustee and a trustor, because there are multiple trustees, each with different trustee attributes (Jarvenpaa, Knoll and Leidner, 1998: 31). It needs to be added that there are also multiple trustors with different trustor attributes.

Creating trust is part of relationship building. It has been claimed that both building and repairing trust in social relationships can only be achieved in face-to-face contacts (O'Hara-Devereaux and Johansen, 1994). Such contacts are difficult to arrange in virtual teams. Because of, for instance, tight deadlines and limitations of the mediated environment, virtual team members simply do not have the time to create trust. Instead, they base their expectations on reputation or previous experiences of similar people. This phenomenon is called 'swift trust' (Meyerson, Weick and Kramer, 1996; Jarvenpaa, Knoll and Leidner, 1998).

With distinction to normal trust, swift trust is based on deliverables of team members – not on social exchanges. It has a rational perspective,

whereas there is no clear evidence of a social perspective. (Meyerson, Weick and Kramer, 1996.) Jarvenpaa and Leidner (1999) also note that trust in virtual teams appears to be somewhat depersonalised. Team members act as if trust is present from the start (Jarvenpaa, Knoll and Leidner, 1998). There is a high degree of task orientation (Meyerson, Weick and Kramer, 1996; Jarvenpaa, Knoll and Leidner, 1998). Jarvenpaa, Knoll and Leidner (1998: 57) conclude: "trusting action is as much an antecedent of trust as an outcome of it".

One should not underestimate the importance of first impression when initiating the connection to other virtual team members. Action that goes beyond the call of duty strengthens trust. (Jarvenpaa, Knoll and Leidner, 1998.) Virtual teams have few possibilities to arrange face-to-face meetings for repairing a broken trust relationship. Case studies have shown that low trust in the beginning of the project seldom leads to high trust in the end (Jarvenpaa and Leidner, 1999).

Studies have also shown that trust among virtual team members throughout all the project modes plays a significant and supporting role. The following factors are regarded as supportive in projects of virtual teams: member support, production performance, group well-being, project goal and technical facilities (Duarte and Tennant Snyder, 2001; Lipnack and Stamps, 1997).

Member support in a virtual team seems to be a rather critical characteristic of a trustable team member. For example, Jarvenpaa and Leidner (1999) found that members who did not support the team were quickly left out of the team. Member support in a virtual team includes active participation, loyalty and true commitment to team and tasks. When participating in a virtual team, an individual's initiative plays an important role and ensures constructive development of the project. Team members with initiative volunteer to take care of project tasks in the beginning, and they give constructive proposals throughout the project. (Jarvenpaa and Leidner, 1999; Jarvenpaa, Knoll and Leidner, 1998.)

Member loyalty is also an important factor affecting trust in a virtual team. A loyal team member "does not take excessive advantage of another even when the opportunity is available" (Cummings and Bromiley, 1996: 303). According to Duarte and Tennant Snyder (2001), she/he behaves as a team member not only towards other team members, but also towards team outsiders.

Social communication and communication conveying enthusiasm facilitate development of trust. Especially in the beginning of the virtual project, talking about non-task specific things – such as free time and hobbies – has a trust increasing effect. Telling about one's own enthusiasm makes others enthusiastic, too. (Jarvenpaa and Leidner, 1999.) Meyerson, Weick and Kramer (1996: 177), however, note that in temporary teams, there are few purely social exchanges, because nothing should subtract from task performance. Probably the most critical characteristic of a trustable team member is, thus, how well she/he performs the tasks assigned for her/him.

Jarvenpaa and Leidner (1999) studied 29 virtual teams executing a programming course at a university. They found out that efficient virtual teams quickly transited from social communication to procedural communication and from procedural to task focusing communication. The members of efficient virtual teams gave substantial feedback to others indicating they really had read the material and thought of how it could be developed. The feedback also came on time. Efficient virtual teams solved project conflicts with a phlegmatic reaction to crises. Trust in the team enables finding a solution to the problem, and the team members did not make the problems at hand any bigger. Meyerson, Weick and Kramer (1996: 190) also found out that there is simply not enough time for things to go wrong, so temporary teams rarely exhibit dysfunctional group dynamics.

Whether virtual team members find being in the team as comfortable and safe as possible is indicative of high trust. Leadership and member roles are factors that affect team well-being. Jarvenpaa and Leidner (1999) observed that positive leadership increases group well-being and thus trust in virtual teams. Good leaders of virtual teams are selected based on their competence in substance – or skills, ability or interest critical for the leadership role. They ensure that the project has a positive impact on each team member's career. Most important, good leaders give positive feedback in public and negative feedback in private. Jarvenpaa, Knoll and Leidner (1998: 57) found that a strategy of rotating leadership reduced dependence on any particular person in the team, and "clear task goals, role division and specificity gave the teams a sense of clear expectation and task systems, and thereby provided the illusion of reduced vulnerability" (cf. Kayworth and Leidner, 2002). These do not seem to differ from requirements of normal teamwork, however.

As most of the communication of virtual teams takes place with the help of information and communication technology, computer-mediated links play a more important role than in collocated teams (Lipnack and Stamps, 1997). A technical link brings with it a notion of uncertainty. If a person does not receive a response to her/his message from others, without trust towards others or a clear response policy, she/he cannot be sure of whether the absence of the response is due to technical problems or others not bothering to answer (cf. Jarvenpaa, Knoll and Leidner, 1998). Consequently, ability to cope with technical uncertainties is essential for efficient project work within virtual teams (Jarvenpaa and Leidner, 1999).

Communication through computers is often claimed to be impersonal. In electronic communication, body language, tone of voice and other non-verbal cues are missing (cf. van der Smagt, 2000). Walther (1997), however, found that electronic communication differs from face-to-face communication only in terms of slower rate of transfer. DeSanctis and Monge (1999) note that according to most studies on electronic communication, the overall amount of communication has increased as compared to face-to-face communication.

Cultural differences between virtual team members are often assumed to make the communication between team members especially challenging (cf. Kayworth and Leidner, 2002). Jarvenpaa and Leidner (1999) found in their experimental study on trust in global virtual teams that cultural differences had less impact on performance than expected. This was because team members shared a similar educational background as programmers. In addition, computer-mediated communication gives members more time to interpret each other's messages.

Practical suggestions for virtual work environments

The fact that members of virtual teams work separately must be taken into consideration when building such teams. Team members need to be able to complete their tasks without anybody monitoring them. According to Jarvenpaa and Leidner (1999), virtual team members should have initiative, be able to handle uncertainty as well as be responsible, dependable and independent (cf. Rouse, 1999).

Jarvenpaa and Leidner (1999) list the following remarks for members of virtual teams:

- It is critical to engage in communication at the beginning of the team's existence and take initiative in participating in tasks at the early stage, since low performing teams generally stick too long in task division.
- Members should provide timely and detailed accounts of the work they are doing.
- Members have to be aware of the need to provide thorough feedback on the contributions of the other members (cf. Duarte and Tennant Snyder, 2001).
- Attention should be paid to quality and predictability matters in communication.

Practical suggestions for leaders of virtual teams and/or virtual organizations, again, may be listed as follows:

- Responsibilities should be defined clearly, both in terms of what and when to do.
- Guidelines could be set on how often to communicate and on forewarning of communication absences.
- It should be ensured that team members share the common goal. (Jarvenpaa and Leidner, 1999.)
- Conflicts should be handled effectively by addressing discontent as early as noticed and in private. However, all positive feedback should be given in public to increase team members' self-esteem.
- Team members should be helped with transitions by standardizing processes, assigning tutors and rotating good and bad jobs.
- Leaders should be aware of their impact on others because others measure team performance by its leader.
- Team needs should be integrated with organizational needs by showing the linkage to other tasks. (Duarte and Tennant Snyder, 2001.)
- There should be an agreement on ways to monitor progress and measure performance – including the 'soft' facts of business performance that indicate qualitative improvements of services and people.
- Activities that are considered non-core or non-strategic could be outsourced.
- Support should be provided (e.g., intranets and groupware) to facilitate communication and information sharing. (Rouse, 1999; Voss, 1996.)

Davenport and Pearlson (1998) add that training should be provided on personal work strategies in a virtual work environment. According to them, to enhance information management within virtual organizations,

- new information flows should be instituted to replace those that are lost when workers leave offices and no longer have physical contact,
- it should be ensured that workers understand the strengths and weaknesses of various technologies for communicating in specific circumstances,
- workers should be educated on how to be more effective providers and consumers of information (cf. Lee and Strong, 2004).

In their study on a toolset for building the virtual enterprise, Katzy and Dissel (2001: 126) emphasize the importance of a 'network-coach'. She/he is "not related to a business opportunity but constantly serves as a coach for the members of the network. This coaching is necessary to create the indispensable co-operative culture of the network and can be achieved by governance of the network, setting business rules and routines for co-operation, providing technological infrastructures in the network and managing relationships (and conflicts)". In practice, this role is likely to be combined with other roles – particularly in small networks – but needs to be emphasized in light of the present dissertation.

Studies on virtual work environments provide essential insights to the present dissertation – both theoretical and practical. There are major differences between, for instance, virtual teams and the networks investigated in this dissertation, but surprisingly many similarities also appear to exist.

3.6   Innovation theories

Innovation theories shed light on the connection between knowing and action. A look into certain aspects of this vast discipline is therefore included to contribute to the theoretical foundation of the present dissertation. The concept of innovation has been defined in innumerable ways. For the purposes of this dissertation, the following definition of innovation by Drucker (1985: 67) is adopted: innovation is "the effort to create purposeful, focused change in an enterprise's economic or social potential". Instead of the limitation to enterprises, the definition is here

understood as covering also other types of organizations – and even networks.

A brief consideration of innovation theories is important for at least three reasons in the present dissertation:

- Innovativeness is inherent in the phenomenon under case study; well-being technology is being developed vigorously, and services related to it are more and more important nowadays. There is an urgent and increasing need for high-quality services enabled by new technology.
- New types of networks are being created around these services, and they require process innovations as well as the activity of committed individuals in order to function well and correspond to the needs and requirements of customers.
- Knowledge management and innovation management are related.

This dissertation thus contains elements related to process innovations as well as innovativeness of (i) the network, (ii) individual organizations and even (iii) individual employees.

Innovation promotors

Hauschildt (1999) drew attention to the central role played by committed and enthusiastic individuals in promoting the creation of innovations – confirmed in many studies in different places in the world. Ignorance and unwillingness have been named as barriers to innovation (Witte, 1977; quoted in Hauschildt, 1999). Witte's concepts of 'power promotor' and 'technology promotor' that mean individuals who help to overcome these barriers are considered important also in light of the present dissertation. However, it has been shown that there is a need for a third concept – 'process promotor' (cf. Hauschildt, 1999).

Process promotors or 'interactive project managers' have a high level of interactive skills, cooperative leadership, above-average problem-solving capabilities and constructive creativity. In place of the process promotor, Gemünden and Walter (1998; quoted in Hauschildt, 1999) have suggested the concept of 'relationship promotor', emphasizing the fact that more and more innovations require cooperation with external partners, for instance, customers or suppliers. In their view, the process

promotor overcomes in-house barriers only. This, indeed, seems to be the original meaning of the concept.

Given the characteristics of the developing virtual networks that provide safety telephone services, the concepts of process promotor and relationship promotor are of particular interest. In fact, the above-mentioned characteristics of process promotors can be argued to be necessary for anyone working in safety telephone services. The work is very demanding and hectic, and employees have to make (often innovative) decisions very quickly – sometimes on the basis of inadequate information about the customer.

For instance, an employee working at a call centre that receives ageing people's alarm calls or inquiries has to make the decision about what kind of a service process to initiate (for example, send an ambulance or a home help). The responsibility is often enormous, and mistakes should not be made. In cases where ageing people call just because they are lonely and need to talk to someone, call centre employees also need good interactive skills and constructive creativity in finding out what to do. In these cases, they also function as relationship promotors, as they need to be skilled in transferring the information about customers' needs and requirements to other actors in the collaboration network as needed.

In the case study of the present dissertation, the concepts and characteristics of innovation promotors are thus of use. This view of safety telephone service personnel as kinds of innovation promotors is not in line with the usual perception of fairly low 'value' of such 'care-related' work. That perception may change in line with the demographic changes and increasing use of well-being technology.

In virtual networks built around safety telephone services, the differences between process promotors and relationship promotors may not be very clear in all cases, as even organizational boundaries may be unclear. One person may have overlapping roles. Yet, it is necessary not to think of the concept of relationship promotor as covering also the concept of process promotor. In the context of the present dissertation, for example, the concept of process promotor could be understood as encompassing a whole network, whereas the concept of relationship promotor could be directed towards relations with customers. (Cf. also the concept of network-coach by Katzy and Dissel, 2001.)

Principles of innovation

Drucker (1985: 72) noted that systematic innovation begins with the analysis of sources of new opportunities. Drucker specifically brought up changing demographics as an opportunity source – in line with the present dissertation. He also noted that would-be innovators must go out and look, ask and listen. They work out analytically what the innovation has to be to satisfy an opportunity, and then they go out and look at potential users to study their expectations, values and needs.

When we look into the operations of virtual networks that provide safety telephone services, it becomes clear that there are concerns, ideas for improvement and numerous innovative people, but their hectic day-to-day work supersedes – particularly in quite small organizations – the search for innovations, no matter how innovative the branch of business itself would be. By investigating information quality, the present dissertation can facilitate the work of the networks and their would-be innovators.

Drucker (1985: 72) further noted that effective innovations start small and try to do one specific thing. A successful innovation aims, for instance, to determine the direction of a new technology or a new industry. These are also aims of would-be process innovations within safety telephone service networks. Through the present dissertation, processes and innovativeness may be improved. Determining the direction of a new technology is also relevant here – if the concept of 'technology' is understood as a combination of technological appliances and services enabled by them. Moreover, small innovations are potentially brought about in information management. They, again, may be sources of value innovation.

Value innovation

Value innovation, as defined by Kim and Mauborgne (1997), implies paying little attention to matching or beating rivals and concentrating on making competitors irrelevant by thinking beyond existing assets and capabilities as well as thinking in terms of the total solution buyers seek. A service network, such as those investigated in the present dissertation, is clearly a case for which value innovation may be of utmost importance.

All parts of the logic of value innovation are not relevant in this dissertation, but thinking in terms of the total solution buyers seek is

significant. Mutual integration of services offered by the networks to individuals is the key here. It is widely recognized in Finland nowadays that services for ageing people require quality improvement and an increasingly 'personalized touch'. This is rendered possible, in part, by new technology and services related to it. Perhaps in a few years, ageing people are able to receive tailored services – a total solution based on their real needs. It does not seem to be far-fetched to say that service networks that work towards providing personalized solutions are likely to be successful in the future.

In general, competitors may be less important for emerging kinds of service networks than for traditional industries, where a certain product can often be fairly easily and quickly imitated. Even there, after-sales service packages and alike are increasingly becoming sources of value innovation. The language of value innovation seems rather similar to that of customer relationship management (or citizen relationship management) in terms of focusing on customers in an unconventional way (e.g., Storbacka, Sivula and Kaario, 2000). In a service network, it is the people who count, their service attitude and qualifications, and those things are difficult to imitate. This is especially relevant in care-related work.

In the present dissertation, the concept of value innovation is thus useful. Only after some time has elapsed after finalizing the dissertation, it will become clearer whether value innovation has really been reached. Are the networks actually 'migratory actors' that offer value improvements or do they settle for conventional logic? One of the underlying intentions of the present dissertation could be characterized as promotion of value innovation logic within the networks in question – in accordance with the logic of action science.

Cross-functional interactions and technology partnerships

Olson, Walker and Ruekert (1995) discuss cross-functional interactions and contend that participative structures are likely to improve the effectiveness and timeliness of the development process, when the product being developed is truly new and innovative. Although Olson, Walker and Ruekert's study is biased towards product rather than service development, it is interesting in light of the present dissertation.

In the kinds of virtual networks that are investigated in this dissertation, participative structures seem to be inevitable. When organizational boundaries are not clear, non-participative coordination mechanisms would seem – not only unfruitful, but also contradictory to the whole 'idea' of this organizational form. Olson, Walker and Ruekert (1995: 49-50) list design teams and design centres as 'recently emerging mechanisms' in ever more rapidly changing environments. Virtual network could be added as a third mechanism to this list. Without it, there would be no place for fairly loose groups of different kinds of actors from public institutions to private firms providing and developing, for instance, services for ageing people. Outside researchers may also have their role in such networks.

Relevant themes for the present dissertation are also controlled chaos (Quinn, 1985) and technology partnerships (Doz, 1988). The service structures related to well-being technology are undergoing great changes and developing rapidly, and development seems chaotic at times. That makes doing research both very interesting and challenging. The essential chaos of development requires a humble attitude of researchers and needs to be taken into account at all stages, even if an intention is to facilitate rationalization.

Doz (1988) focuses on technology partnerships between firms of different sizes. Characteristics of partnerships are, indeed, important in investigating information flows in networks, but they have barely been studied in environments such as those investigated here. It is not easy to categorize whether this dissertation deals with incremental innovation, technical innovation, application innovation or radical innovation (Salomo, 2001). There are elements of all these types. However, perhaps the most apposite concept would be application innovation.

3.7   Conclusions of the literature review

The relations between the theoretical approaches presented could be summarized as follows (Figure 10). The arrows illustrate the two-way connection that the different approaches have with each other.
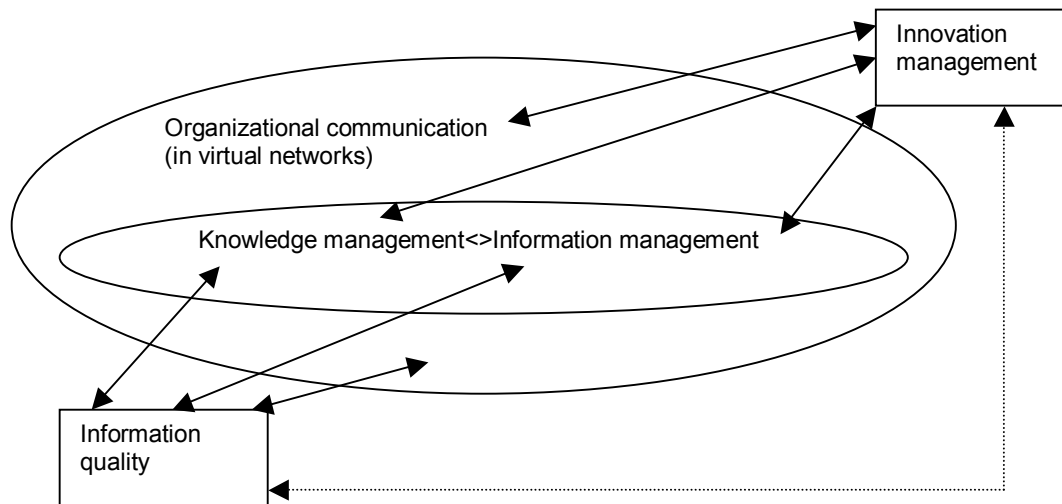
Figure 10. Relations between the theoretical approaches of the dissertation

The literature review clearly showed that:

- There is an increasing understanding among researchers and managers of the importance of information quality and of managing it.
- There is a need and plenty of room for new practical methods for studying information quality on the basis of qualitative data.
- The earlier methods have been overwhelmingly quantitative.
- The methods developed earlier do not appear to capture, for instance, the changing, processual character of information.
- The methods developed earlier provide a very sound theoretical and practical basis to build on.

Conclusions concerning the theories on information management, knowledge management, organizational communication, network management and virtual teams/ virtual organizations as well as innovations were placed in the relevant chapters in the text. The same applies to the assessments of the applicability of the theoretical approaches to the present dissertation. In summary, the information quality approach alone is considered to be a necessary but not sufficient basis for this dissertation. The other approaches were found to be relevant and applicable to important parts of the dissertation.

Obtaining a general, comprehensive understanding of the branch of safety telephone services, on the other hand, has shown that:

- They are often offered by emerging, interesting types of virtual networks.
- Content and flows of information have a particular meaning; the services are almost entirely based on them, and their character is related to health and need of help – major issues for individuals.
- Despite the understanding among practitioners of the need to study the functioning of the whole service system behind safety telephone services, it has barely been studied.
- There is thus a practically relevant problem that has research potential – suitable for operationalization.

4 Methodology

4.1 The qualitative research approach

The present dissertation complies with the tradition of qualitative research. The choice of a scientific approach obviously depends on many factors, but this dissertation is inherently qualitative. It involves an intensive investigation of a particular phenomenon in a number of networks, interprets the results with more subjective methods of analysis than quantitative research (cf. Laudon, 1989) and stresses the aim of achieving a profound understanding of intentional human action (Pihlanto, 1994; Burgess, 1991).

The subjectivist research perspective is central in the present dissertation. Information flows and management involve human actors, who are able to choose the actions to be taken (Lukka and Kasanen, 1993). Also the knowledge created in this dissertation is essentially subjective by nature. The dissertation is a combination of constructive research and action science – it develops a new qualitative research methodology for analysing information quality and operationalizes it, but it also concentrates on change, is problem-oriented and context-specific, and the search for facts is followed by reflection, planning (and action).

The aim is to produce results that are comprehensive and relevant both for managers, employees and academic scholars. The aim is also to maintain an open and continuous communication process between the researcher and the case networks to achieve a profound understanding of the phenomena that are studied. As expressed by Evered and Louis (1981: 390), categories and features of essential information are noticed and identified through an interpretive and iterative process. The process represents an experiential exploration based on existing theories and previous research.

The process mentioned above is especially interesting in the present dissertation, as the body of scientific knowledge that would clearly focus on this particular field is quite limited. This dissertation deals with such a novel, innovative and developing field that studies done on other, closely related fields needed to be investigated and understood. These included the fields of knowledge management, organizational communication,

network management, virtual organization and virtual teams as well as innovation theories.

The fields of well-being technology and gerontechnology and services related to their use are characterized by constant technological change and innovation. The topic of the present dissertation is one of the novel elements produced by this change and innovativeness. According to Benbasat, Goldstein and Mead (1987: 370), the qualitative approach is particularly appropriate in research fields that are at their early, formative stages and in situations where it is necessary to generate theories and conceptualisations from practice. This characterization is applicable to the present dissertation, making the qualitative approach highly appropriate.

4.2 The case study method

The case study method was a natural choice for the present dissertation – for the operationalization of the new methodology developed. It is common in situations where the purpose is to find answers to 'how' and 'why' questions, focusing on understanding the dynamics present within single settings (Yin, 1989: 18; Eisenhardt, 1989: 534). Yin (1989: 23) further defines the case study method as an empirical inquiry that "investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used". It has also been stated that case studies seem to be valuable in research settings that delve in depth into complexities and processes, concentrate on unknown innovative systems and aim at revealing informal and unstructured linkages and processes in organizations (Marshall and Rossman, 1989).

To summarize, the key characteristics of the case study method as adapted from Benbasat et al. (1987: 371) are as follows:

- The phenomenon is examined in a natural setting.
- The data are collected by multiple means.
- The complexity of the unit (one or only a few) is studied intensively.
- No experimental controls or manipulation are involved.
- The investigator may not specify the set of independent and dependent variables in advance.
- The results derived depend heavily on the integrative powers of the investigator.

Case studies are often criticized on the basis of, for instance, insufficient design of the research logic and protocol. This easily leads to weaknesses in the presentation of the actual research process and in establishing a trustworthy chain of evidence between theories, data and introspection (Viitanen, 1998: 101). Extra discipline is therefore exercised in the present dissertation to gain credibility. Gummesson (1991: 77) summarizes the criticism of case studies as follows:

- Case studies lack statistical validity.
- Case studies can be used to generate hypotheses but not to test them.
- Generalizations cannot be made on the basis of case studies.

On the other hand, Gummesson (1991: 76-79) responds to that criticism as follows:

- Case study research provides the opportunity for a holistic view of a process.
- Case studies can be of particular value when research aims to provide practitioners with tools.
- In certain areas, case studies represent the only possible research strategy.
- What is actually the meaning of 'generalization'? "It no longer seems so 'obvious' that a limited number of observations cannot be used as a basis for generalization. Nor does it appear to be 'obvious' any longer that properly devised statistical studies based on large numbers of observations will lead to meaningful generalizations." (p. 78.)
- When the measurements in case studies are comprehensive enough, it is possible to reach a fundamental understanding of the structure, process and driving forces rather than a superficial establishment of correlation or cause-effect relationships.

The importance of basing the work on existing theories and previous research results in the field is self-evident, but it needs to be re-emphasized that studies on information quality with a qualitative case study approach are very rare. Therefore, to improve credibility, multiple data collection methods and triangulation are utilized.

4.3 Unit of analysis and site selection

There are several foci and levels of analysis in organizational research. Levels of analysis can be (i) individual, (ii) inter-individual, (iii) organizational and (iv) inter-organizational. The focal unit under (i) can be owner, management or worker, under (ii) collective, under (iii) organization and under (iv) organization or population. Main issues under (i) are: investment, resource allocation, efficiency, profit, decision-making, goal setting, control, renewal, division of labour and coordination of work processes. Main issues under (ii), (iii) and (iv) are, respectively, (for ii) commitments, institutions, communication, language, power, culture and collective social activity; (for iii) structure, inputs and outputs, information processing and business processes and (for iv) value chains, inter-organizational networks, core processes, adaptation and competition. (Tuomi, 1999: 225, Table 6.)

With regard to today's ever increasing interorganizational contacts, communication and information processing should be added under main issues for (iv). Tuomi (1999: 226) notes that – although organizational information processing has been a major theme in organizational research – the economic, administrative and ecological perspectives have only rarely and indirectly discussed the creation, use and nature of organizational knowledge. To the author of the present dissertation, this seems to be due to the traditional, narrow view of organizational information processing that emphasizes information systems only (or overwhelmingly). However, if organizational information processing is seen from a much wider perspective that covers also the human dimension, organizational knowledge essentially comes in. Quality information is essential for explicit knowledge as well as for the foundation of organizational knowledge (cf. Huang, Lee and Wang, 1999).

In line with the research objective and purpose of the present dissertation, the appropriate unit of analysis is the entire networks of organizations. However, this dissertation also focuses on specific processes – information flows. The question of the unit of analysis is further complicated by the fact that an investigation of networks' information flows and management cannot ignore individuals, working groups, organizational units and individual organizations. There are, therefore, several levels to be investigated in the present dissertation. According to Yin (1989: 49), such an embedded case study design that focuses on multiple levels of the investigated phenomenon at the same time adds significant opportunities for extensive analysis.

This dissertation is a cross-case analysis, where different cases are compared and common themes discerned. A single case study would be justified when it represents a critical case for testing a well-formulated theory, is an extreme or unique case or serves as a revelatory case for observing and analysing a phenomenon previously inaccessible to scientific investigation (Yin, 1989: 48; Benbasat et al., 1987: 373). The present dissertation is based on development of methodology – not on testing of a well-formulated theory – and discusses cases that are neither unique nor inaccessible. Moreover, covering the various types of service environments of safety telephone services increases validity and reliability of this dissertation. The dissertation could be defined as both an inductive and a deductive study. Through theoretical reasoning, the sites that might provide answers to the research questions were identified, and the chosen research sites met the criteria.

4.4 Data collection and analysis

4.4.1 Data collection methods and research protocol

The data collection for the present dissertation was done following the general principles of conducting case studies (Yin, 1989: 84): (i) using multiple sources of evidence, (ii) building up a case study database and (iii) maintaining the chain of evidence between theory, data and interpretation.

According to Yin (1989: 146), good sources of evidence in qualitative research may include:

(i) documentation,
(ii) archival records,
(iii) interviews,
(iv) direct or participant observation,
(v) physical artefacts.

Benbasat et al. (1987: 374) have stated that the goal of data collection from multiple sources is to obtain a rich set of data surrounding the specific research issue and to capture the contextual complexity. This form of a research strategy is usually described as triangulation (Webb et al., 1966). Single method designs may have many strengths, but they usually also have many weaknesses, making triangulation highly desirable (Jick, 1979). According to Jick, data collection from multiple

sources – the 'between (or across) methods' type – represents the most popular use of triangulation.

In the present dissertation, data are collected from four of the five above-mentioned sources. They include: (i) written material ranging from memoranda to minutes of meetings and formal reports, (ii) organization charts, personal records, maps, graphs, service statistics et cetera, (iii) open-ended and semi-structured interviews, use of informants and intraorganizational and interorganizational workshops as well as (iv) absorbing and noting details and actions in the field environment.

Structured interviews and written questionnaires were seen as inappropriate for a dissertation of this kind. It is not likely that they would unfold the participants' true views of the complicated phenomenon of information within the case networks. Therefore, semi-structured and open-ended interviews were undertaken. The interviews assumed a conversational manner, but the interviewer followed a pre-prepared set of questions (cf. Yin, 1989). The interviews were loosely structured steered conversations around the networks' characteristics, information flows and management as well as problems in them. The basic structure of the interviews is shown in Annex 1.

The interviews lasted for approximately two hours. Formulation of the structure of the interviews was guided by (i) the theories presented in the review of existing literature, (ii) the information quality analysis framework, (iii) existent literature on operationalizations of the concepts used in the above-mentioned framework of analysis, (iv) five exploratory study visits to organizations involved in safety telephone services and (v) studies of reports and other materials concerning the services in question as well as well-being technology/ gerontechnology more generally.

After constructing the set of interview questions, it was pre-tested with the help of six interviewees, who represented different professions involved in safety telephone services. Conducting the test interviews helped in modifying and complementing the set of interview questions in order to increase the chances of obtaining higher quality responses. The test interviews were conducted according to the same scientific criteria as the other interviews, and the data obtained through them are also taken into account in the analyses of information quality and network collaboration. This decision was supported by the fact that the test interviews did not result in any substantial changes in the set of questions.

Each interview session began with a short introduction of the research project. The introduction was quite general in order to avoid leading the interviewee. In a few test interviews, the questions were sent to the respondents beforehand, but later, this was not done. Some of the interviews were rather combined interview and observation sessions than 'pure' interviews. This was – in a few cases – necessary due to the hectic environment of safety telephone services, for instance, at the call centre that receives alarm calls.

The interviews were audiotaped for analysis. Verbatim transcripts from the audiotapes were prepared. Discussion at one of the interorganizational workshops was also audiotaped and transcribed, while at the other workshops and seminars, field notes were made. The summarizing and packing of transcribed interviews and write-ups on workshops and seminars were based on the themes (codes) of the semi-structured interviews as well as the framework of analysis for information quality (Table 7). After reading, coding and analysing the data, the results were sent to the interviewees for feedback and comments. The results were also discussed at three intraorganizational and five interorganizational workshops, seminars or meetings.

The other data collection methods (written material, records, statistics and alike) were utilized to gather background materials. The interviews were the main data collection method, combined with workshops and note making.

Selection of networks and interviewees

The networks of the present dissertation consist of several different types of safety telephone service networks in Finland – and one in Sweden. The branch is very fragmented, covering at least approximately 70 000 customers[4] and, in principle, all the municipalities in Finland. That is, it is the duty of municipal authorities to give guidance on private safety telephone services, if the municipality in question does not have a system of its own. Many municipalities do have systems of their own or they purchase the service from a private service provider. Within one municipality, there may even be several systems simultaneously. For

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[4] Interestingly, there is no reliable figure for the total number of customers in Finland. Recent estimates range from 15 000 to 70 000 customers. The figure given here is believed to be sufficiently accurate on the basis of the numbers of customers of the privately operated systems and other information on the branch.

instance, there may be internal systems in blocks of service flats, a municipal system as well as several private systems in operation at the same time.

No nation-wide survey of the branch of safety telephone services has been undertaken in Finland since 1992, when Lehto and Vuoksenranta (1999) mapped the municipal safety telephone services by sending a questionnaire to all the municipalities. No survey has been undertaken on the private sector services or on the industry in its entirety.

The private sector safety telephone services have undergone large structural changes recently. Due to mergers and acquisitions, there are now only two major nation-wide systems in Finland, run by private companies. Together, these systems have approximately 19 000 customers. In addition, there are regional systems run by companies – covering several municipalities – as well as company-operated systems in one locality only. There are also those that could be called semi-public systems. These are operated by foundations or non-governmental organizations and sometimes partially supported by municipal or other public funds.

The branch of safety telephone services will likely undergo many interesting changes also in the near future, because of, inter alia:

- development of technology; mobile safety telephones, well-being wristbands, various accessories such as door alarms, fire alarms and epilepsy alarms,
- increasing amount of users due to ageing of the population, increasing compatibility with other types of appliances and increasing use of technology in general among ageing people,
- financial pressure on public services,
- improving understanding of the importance of integrating the customers' points of view into services,
- development of new forms of work, such as call centres,
- development of networking and virtual teams,
- improving understanding of the importance of a generally safe and accessible environment; development of Design for All thinking as well as
- challenges of the building industry; the relationship between construction and renovation, on the one hand, and well-being technology/ gerontechnology, on the other hand.

The networks that were selected for the present dissertation reflect well the fragmented safety telephone service environment. The interviewees represented different kinds of safety telephone service systems. Some of them were from completely municipally operated services, some from privately owned blocks of service flats and some from project-based pilot services testing newest technology in the field. The largest group of interviewees represented a nation-wide network offering safety telephone services around Finland. In addition, interviews were conducted in a big municipal network in Sweden to obtain a more complete picture. There is no corresponding large-scale municipal system in Finland. Table 4 shows the variety in the types of service networks.

Table 4. Types of safety telephone service networks investigated

Type of network	Number of organizations involved (*)	Geographic area	Number of interviewees
National, company-operated	~ 100	Nation-wide, Finland	24
Municipal, medium-sized city (2 networks)	~ 10	Southern Finland	2 + 2
Block of service flats, operated by a cooperative, medium-sized city	~ 5	Southern Finland	2
Individual customers, operated by a non-governmental organization, medium-sized city	~ 5	Eastern Finland	3
Municipal, big city	~ 100	Sweden	3 (**)
Pilot project testing new technology, small town and countryside	~ 10	Western Finland	4
Block of service flats, operated by a foundation, small town	~ 10	Western Finland	2

Notes:
(*) The figures are estimates to show a rough order of magnitude. There is variation in, for instance, who is perceived to be a network member and which municipal organizations are perceived to be separate.
(**) Particularly long, in-depth interviews.

Descriptive statistics on the sample networks and interviewees

The Finnish nation-wide network is by far the most interesting and challenging with regard to information-related issues and network collaboration. It received the most intensive attention in the present dissertation. Inclusion of the other types of networks for comparison increases the validity and reliability of the results. The bias in favour of the nation-wide system does have an impact on some of the emphases, but, on the other hand, challenges and development needs are largely the same in all kinds of safety telephone service networks – apart from the very small internal networks in blocks of service flats. One safety helper or organization may be included as one link in, for instance, two different safety telephone service systems, one municipal and another nation-wide. Individual employees and organizations may thus have several overlapping roles.

The individual interviewees were selected using the reputational sampling technique (Laumann, Marsden and Prensky, 1983) and the snowball sampling (Scott, 2000). These are generally applied in network studies (Viitanen, 1998). The first interviewees were selected based on their reputation as informative sources within the case networks. They, for instance, serve as cooperative liaisons or contact persons between individual organizations within the networks – or individual units of an organization. The number of respondents was, however, increased and further connections were detected during the research process. Due to characteristics of the networks and the service branch, the amount of documentation and archival records is very limited indeed, making interviews and observation particularly important.

Interviews were carried out among providers of safety telephone services around the country in Finland as well as in one locality in Sweden. The investigation was undertaken in the period from August 2001 to May 2003, which included the study visits, test interviews, actual interviews, seminars, workshops and observation. An overwhelming majority of the interviews were undertaken in April and May 2002. The first very tentative results were presented in June 2002, and the results have since then been discussed in numerous occasions with collaboration partners, interviewees and others concerned with safety telephone services. This has made the research process iterative and communicative. The interviewees also received a draft report with the results in January 2003 and were asked to give feedback and comments.

The municipal social and health care sector was well represented among the interviewees, but the interviews were directed in a balanced way to companies as well. Representatives of non-governmental organizations were almost as numerous as interviewees from each of the other two groups mentioned above. The picture gained by the interviews around Finland was comprehensive, and the types of organizations and professional groups were representative of the branch. The age range of the interviewees covered all age groups in an unbiased manner. Examples of managerial occupations were managing director, director of block of service flats, director of municipal services for the elderly and home care supervisor. Examples of employee occupations were social worker, home help, clerk and planner. Table 5 gives detailed information on the interviewees.

Table 5. Demographic data on the interviewees

Type of organization	Company	12 interviewees
	Municipality	12
	Non-governmental organization	10
	Foundation	3
	Cooperative	3
Gender	Women	29
	Men	11
Position	Manager	20
	Employee	20

Notes: The figures are not the same as in Table 4 due to the fact that in a few cases, one interviewee represented two networks.

Primary populations served by the agencies investigated in the present dissertation cannot be disclosed one by one due to confidentiality agreements. In the presentation of the results in this dissertation, many descriptive quotations from the interviews are included. After these quotations, only the type of organization of the interviewee is disclosed. This decision was based on the fact that the type of organization was a decisive factor – in addition to the type of network – whereas gender, age, occupation or position did not seem to have a significant effect on the responses. However, in addition to descriptiveness of the quotations

chosen, where possible and meaningful, even distribution across the above categories (Table 5) was strived at in the selection process.

Of all the 40 interviews, 34 interviews were undertaken by the researcher herself. In half of these interviews, there was another or several other researchers present. Six interviews undertaken by two other researchers were used in the analysis, in the comparison between the nation-wide network and the other networks. As background information, 40 interviews undertaken by another researcher among customers of safety telephone services were used (cf. Pekkarinen, 2003). Results of a survey undertaken at a large call centre were also used as background information (cf. Molander, 2003).

The number of interviews was partly determined by the size and number of the networks. The interviews undertaken were sufficient; at the end, there seemed to be no need to continue with further interviews, as the marginal utility of additional interviews diminished clearly. This is in line with the argument that the actual number of cases needed in a specific study is determined by saturation (Glaser and Strauss, 1967; Gummesson, 1991).

The interviews focused on the courses of information flows in safety telephone services, critical bottlenecks in them, different roles of the different actors in relation to information, types and content of information being transferred and the operational logic in arranging information processes. The investigation was directed towards all information types and processes that are relevant for safety telephone services. The interviews also gave a wealth of information related to network collaboration and network management.

An important principle concerning the collection of empirical evidence in case studies is related to the way of organizing and documenting data. Yin (1989: 99) has suggested that the researcher should build up and maintain a case study database consisting of notes, tabular materials, narratives and documents of the study. For the present dissertation, a database has been built to manage the study efficiently. Raw data and the interpreted materials are kept separate. All notes, documents and interim reports are stored.

The requirement of maintaining the chain of evidence between theory, data and interpretation is fulfilled throughout the data analysis by

describing how classification of data, theme identification and other such steps are taken (Chapter 5).

4.5 General remarks on the analysis of data

There are, according to Yin (1989: 106), two alternatives for a general analytic strategy of a study. The first and more preferred alternative is to rely on the theoretical propositions that led to the case study by creating a clear connection to the assumptions of the study and inducing the framework for analysis from a well-established theoretical foundation. The second descriptive strategy alternative implies developing a case description, which is less preferable because it lacks a firm theoretical basis. The descriptive strategy is acceptable in studies that only aim at capturing the knowledge and patterns of a specific phenomenon and formalizing it to a scientific description.

The present dissertation overwhelmingly utilizes the first of the above-mentioned alternatives. The framework for analysis of information quality is induced from a firm theoretical foundation. The innovative and rapidly developing field of well-being technology based safety telephone services for ageing people is relatively unresearched, but it is claimed that a firm theoretical foundation is not necessary for the operationalization of the said framework of analysis by means of a case study.

The qualitative data are analysed with the help of mainly qualitative analysis techniques. Some quantification is, however, undertaken – in line with the fact that triangulation through mixing qualitative and quantitative methods has long been encouraged, by Jick (1979), inter alia.

To sum up, the present dissertation is based on an investigation made in natural empirical settings following the described qualitative approach. The empirical data were collected in complex network contexts. An explicit research design and protocol were constructed. The case study is carried out following the cross-case analysis rationale and design, and the main unit of analysis is the network level – with an embedded analysis of data from the sub-levels as well.

The combination in the present dissertation of (i) operationalization of a well-structured framework for information quality analysis and (ii) a complementary analysis of network collaboration represents a combination of (i) constructive research and (ii) action science. In

constructive research, problems are solved through the construction of models, frameworks, diagrams, plans and alike. After identifying research potential and obtaining a general understanding of both information quality research and practice as well as safety telephone services, an innovative solution idea, the framework of information quality analysis was constructed. All this is in line with the phases of constructive research (cf. Kasanen, Lukka and Siitonen, 1993). Table 6 further clarifies the approach of the present dissertation in relation to scientific practice.

Table 6. The approach of this dissertation in relation to scientific practice

Phase	Action	Approach
Finding a practically relevant problem that also has research potential	Getting acquainted with (i) information quality and (ii) safety telephone services	Constructive research
Obtaining a general and comprehensive understanding of the topic	Literature studies, methodological discussions, discussions with practitioners within the branch, study visits, collection of background data	Constructive research
Innovating, i.e., constructing a solution idea	Framework of information quality analysis and related tools	Constructive research
Demonstrating that the solution works	Operationalization of the framework of information quality analysis	Constructive research
Learning and development	Investigation of network collaboration	Action science
Active improvement of practice	Preparation of practical recommendations	Action science
Showing the theoretical connections and the research contributions of the solution concepts	References made in the operationalization, discussion, assessment of validity and reliability, conclusions and suggestions for future research	Constructive research
Examining the scope of applicability of the solution	References made in the operationalization, discussion, assessment of validity and reliability, conclusions and suggestions for future research	Constructive research

According to Argyris, Putnam and McLain Smith (1985), becoming an action scientist involves learning to reflect on reflection-in-action, making explicit the theories-in-use that inform it and designing new theories-in-use. It is acknowledged that this type of an approach may lead to problems regarding replicability and – consequently – reliability. Causes and effects may be unclearly established. However, Gill and Johnson (1991: 124) argue that when large amounts of qualitative data are produced in an inductive fashion, this is "perhaps the most likely of all strategies to identify and include all the relevant variables in any subsequent theoretical analysis. […] At each stage … the deductive researcher is, in effect, excluding variables from consideration […]. To put it crudely, the [deductive] researcher is throwing information away".

During the research process of the present dissertation, inductive and deductive phases have alternated. It is argued that information has not been thrown away. The grounded theory approach has also had an impact on the present dissertation. In the following description, stages of grounded theory are indicated in parentheses (cf. Glaser and Strauss, 1967).

In the formulation of the framework of information quality analysis, a deductive process took place, as after the collection of background information on safety telephone services (familiarisation), literature studies on information quality and study visits (reflection), the researcher started to exclude variables from consideration and limit the extent and form that data could take in an *a priori* fashion (conceptualisation and cataloguing concepts). This resulted in the framework of information quality analysis to be operationalized.

Thereafter, a partly ethnographic approach (Gill and Johnson, 1991: 124) was adopted with a commitment to induction and data collection through semi-structured interviews. The data were analysed both with the help of the framework of information quality analysis and with regard to network collaboration (classification). Variables were linked into the relevant theories and re-evaluated.

The combination of the structured analysis of information quality and the somewhat more general analysis of network collaboration is considered to help greatly in becoming aware of important factors that did not form part of the preconceived notion of the situation of the author of this dissertation (cf. Gill and Johnson, 1991). The combination is also intended to capture both information that is managed in a controlled way and information that

is managed spontaneously (cf. Ståhle and Grönroos, 1999: 80). In the present dissertation, information quality considerations contribute to management of information in a controlled way. Network collaboration considerations contribute to understanding (i) information managed in a spontaneous way as well as (ii) the environment of information managed in a controlled way. As the objective of this dissertation is to develop and operationalize a new methodology, this chapter only included certain general remarks. Chapter 5 contains the detailed description.

5 Results of methodology development

5.1 Development of tools for information quality analysis

5.1.1 Framework of information quality analysis

The information quality analysis framework is proposed in the present dissertation as a tool to investigate the quality of the different types of information that are transferred in the case networks. Information quality is one slice of the whole of information management. It is, however, a very important slice that is often forgotten due to, for instance, extensive attention to information systems – or, on the contrary, various knowledge management initiatives concentrating overwhelmingly on utilization of tacit knowledge. Methodologies for studying information quality have been developed, but they are overwhelmingly quantitative (e.g., Lee, Strong, Kahn and Wang, 2002). Moreover, networking and virtualization are trends that call for new ways of looking into information quality. It is also necessary to pay increasing attention to information as a process in investigations of information quality.

The information quality analysis framework helps in identifying information quality dimensions that are weak in a network (or in an individual organization). The associated investigation of network collaboration helps in identifying weaknesses and strengths in network collaboration that affect management of information quality.

5.1.1.1 Basis and development of the information quality analysis framework

The information quality analysis framework was elaborated primarily on the basis of the works of Wang and Strong (1996), Strong, Lee and Wang (1997a; 1997b) and Wang et al. (1998). Their work was part of the Total Data Quality Management Research Program of Massachusetts Institute of Technology. Their studies gave a sound empirical and theoretical foundation for the present dissertation. The evidence is strong and convincing, and their data quality framework has been used effectively in industry and government (Wang and Strong, 1996). However, these researchers have also called for further research to apply their framework in specific work contexts.

Lillrank's (1998) apposite summary of challenges of information management also contributed to the framework. The summary reads as follows: "If the right piece of information in the right format is at the right place at the right time, action is relatively easy and predictable" (p. 7). It is here complemented by two issues, the first (the right source of information) and the last (handled in the right way) of the six stages of analysis in Table 7. A complemented summary reads as follows: *If the right piece of information from the right source and in the right format is at the right place at the right time and handled in the right way, action is relatively easy and predictable.*

For each stage of analysis, appropriate dimensions of information quality were assigned from those listed in Wang and Strong (1996). For another branch of business, dimensions to be assigned for the six stages could be different, depending on the operations. Choice of dimensions for the six stages was an iterative, cyclical process affected by gathering of background information on the branch of safety telephone services, study visits and test interviews.

Combining dimensions of information quality with the six stages of analysis provides an essentially novel way to assess information quality on the basis of qualitative data. The dimensions were not changed in the actual analysis of interview data – firstly, because the aim was to test and operationalize the framework of Table 7 and secondly, because the choice had seemingly succeeded in capturing the relevant dimensions.

The starting point was that all the dimensions from Wang and Strong (1996) are included at each stage. However, that would have made the qualitative analysis quite heavy. Therefore, on the basis of the data collected, the author started to exclude dimensions from consideration. The data showed the necessary exclusions relatively clearly. Where there was unclarity, the dimensions were kept. The assignments were based on an assessment of the definitions of dimensions of information quality, aims of the six stages of analysis as well as the data collected (knowledge of the branch). In this phase, also a few 'service-specific' dimensions were added (see a separate description). The result was the framework that is shown in Table 7, and subjected to testing and operationalization.

Table 7. The framework of information quality analysis

Stages of analysis	Information quality dimensions
Basis: the right source of information	Relevancy, timeliness, completeness Accuracy, objectivity, believability Accessibility, security
Component: the right piece of information	Relevancy, value added, timeliness, completeness, appropriate amount of information
Content and instrument /means: in the right form	Accuracy (including accurate coding of message), objectivity, believability, reputation Interpretability, ease of understanding, concise representation, consistent representation Ease of operation, traceability, flexibility
Timing: at the right moment	Timeliness, relevancy Appropriate velocity
Routing: in the right place	Accessibility, security Relevancy, value added Traceability
Processing procedures: handled in the right way	Accessibility (intellectual and physical), security Interpretability, ease of understanding, concise representation, consistent representation Traceability, cost-effectiveness, ease of operation Authority of person handling, appropriate velocity, sustainability (costs, ethical aspects)

In the interviews, it became quite clear that collecting data from the interviewees for making the assignments would have led to meagre and unreliable results. The interviewees from safety telephone services are not used to thinking about information at a conceptual level. Even at the practical level, these things are felt to be somewhat difficult to grasp. The case environment thus caused quite many special challenges in the dissertation. This dissertation is also felt to be a good 'case' with regard to the cumulative character of science – the topic deserves further research.

Developing a list of criteria for the assignments could even be counterproductive in environments, where the topic of information and information quality first need to be made visible. It seems that criteria

could be developed in future research at the level of an individual organization – or rather, a couple of organizations, where people would agree on the assignments in joint discussions, and the researcher would then document their reasons for the assignments and develop a list with the help of those. The persons would need to be knowledgeable about the topic of information quality. However, also 'difficult' network environments need to be studied.

The word 'right' in the framework in Table 7 means the opposite of wrong. It cannot be given a universal definition, as situations and contexts vary. It refers to three levels: (i) the level of the individual ageing person, (ii) the level of the service environment /structure and (iii) the technical level. Transfer and quality of information have to be 'right', in other words, they would have to fulfil the requirements at all these levels.

The information quality analysis framework was designed with the aim of taking into account the context dependent variables as well as information as an output and a process. Within safety telephone services, for instance the information that is given by a customer in an alarm call transforms as the service process advances. This is the reason for not testing Wang and Strong's seminal framework of information quality (Figure 6) as such. Their information quality dimensions have here been placed in an innovative way under the different stages of analysis.

Wang and Strong (1996) note that most studies in the field of information quality fall into the intuitive category, but what they mean with it is that a researcher selects the quality dimensions she/he finds important. In the present dissertation, the approach is different – all the quality dimensions from Wang and Strong (1996) are included, but they have been inserted into the newly constructed framework. This brings with it the advantage of utilizing a framework that suits the particular characteristics of the present dissertation – but that is, on the other hand, flexible to be used in other branches or organizations as well.

5.1.1.2 Applicability within other branches or organizations

In the case of the present dissertation, data for applying the information quality analysis framework were collected mainly through interviews. In this way, the voice of professionals in the field was captured. Depending on the environment, there might be other possible ways, but that will be an issue for future research. An individual team or group of people,

possibly even a small workplace could apply the information quality analysis framework by doing the mapping of information flows in joint discussions.

After the joint discussion, they could continue by choosing the relevant dimensions of information quality for each stage of the analysis on the basis of their experiences and discuss the chosen ones – in the context of the different types of information that have been identified jointly. In the discussion, strengths and weaknesses would be identified, and corrective action for improved management of information quality could be agreed upon jointly, including an agreement on 'who, what, when and how' to act. A facilitator might be necessary in most organizations, but perhaps a small team could test the information quality analysis framework even without a facilitator.

As the information quality analysis framework is relatively simple, it can be applied in different environments. It can be tailored to meet the needs of the environment in question by choosing appropriate dimensions of information quality. The choice for each stage of analysis can be done by an outside researcher, as in the present dissertation, or by an 'insider', a group of people or the whole organization. The framework captures both universal problem areas (through the six core stages of analysis) and branch-specific problems (through the choice of dimensions of information quality for each stage of analysis). The framework is thus proposed to be usable in the future as both a tool for self-assessment and a tool for researchers who investigate a larger system or systems.

The environment in the present dissertation is a 'network of networks' – several cases that the researcher investigated as an observer. This is a challenging environment for any kind of an analysis related to information, just as it is a challenging environment for anyone wishing to manage information quality. A further discussion of applicability within other branches or organizations is an issue for future research.

5.1.1.3 Application within safety telephone services

On the basis of the iterative process and the understanding of safety telephone services, a couple of 'service-specific' dimensions were added to the information quality analysis framework, besides the dimensions from Wang and Strong (1996). The service-specific dimensions are the following:

- under the stage of analysis 'content and instrument /means': for accuracy, an explanatory addition: accurate coding of message; ease of operation, traceability, flexibility,
- under 'timing': appropriate velocity,
- under 'routing': traceability,
- under 'processing procedures': for accessibility, an explanatory addition: intellectual and physical; traceability, cost-effectiveness, ease of operation, authority of person handling, appropriate velocity, sustainability (costs, ethical aspects).

Traceability, cost-effectiveness, ease of operation and flexibility are dimensions that were originally included in Wang and Strong's framework but which the authors later eliminated, because these dimensions could not be readily assigned to any category (intrinsic, contextual, representational or accessibility information quality), and they were not ranked highly in terms of importance. They have been re-introduced in the present dissertation because of an assessment of their importance in safety telephone services, based on the data collected.

Accurate coding of message is included as an explanatory remark for accuracy under the stage of analysis 'content and instrument /means'. This is intended to reflect the occasional difficulty in interpreting customers' needs when an alarm call is received at a call centre. How the person on duty interprets the customer's message and transfers the information forward to the collaboration network may have a major impact on overall service quality. Interpretation is likely to depend largely on the call centre personnel's tacit knowledge and experience, but it is an issue that needs to be brought up in an information quality analysis.

Appropriate velocity is a concept that is related to both accessibility and timeliness, but it is felt to be insufficiently covered by them. Yet, it needs careful attention particularly in the context of safety telephone services. Appropriate velocity has to do with how quickly incoming calls are answered at a call centre, how quickly relevant service providers are called out to provide help, how quickly help is finally provided to the customer, how quickly changes in customer information are inserted into the customer database and so forth. There may be definitions or guidelines as to how quickly help is provided – for instance, within half an hour – but the velocity dimension seems to require increasingly systematic attention with regard to all types of information.

The explanatory remark concerning accessibility – intellectual and physical – is intended to highlight the importance of handling information in a way that ensures intellectual accessibility within the often very heterogeneous collaboration networks of safety telephone services. As the networks may consist of representatives of many different professions in many different locations and work environments, intellectual accessibility of customer or other types of information is not self-evident, even if physical accessibility (the extent to which information is available or easily and quickly retrievable) would not cause any problems.[5] Intellectual accessibility is closely related to ease of understanding and interpretability but more wide-ranging, requiring a more comprehensive consideration of collaborators' points of view and needs.

Two new dimensions remain to be described. Authority of person handling has to do with confidentiality of health-related information. This matter is at a level different from the other dimensions. It is intended to highlight the importance of the security dimension and widen its sphere. As to sustainability, costs and ethical aspects require our consideration. Sustainability with regard to costs is connected to cost-effectiveness (the extent to which the cost of collecting appropriate information is reasonable), but concerns the whole of safety telephone services. In addition to the cost of collecting information, also the costs of storing and transferring information, the costs related to information systems and the quality costs of missing, incomplete and incorrect information, inappropriate or inefficient services as well as of missing follow-up and assessment of customers' services should be taken into account.

Sustainability with regard to ethical aspects has to do with overall practices and management of information processing in a way that ensures consideration of the customer's point of view. The precise ethical aspects have to be defined at the level of an individual organization and – where relevant – the collaboration network, depending on the exact type and combination of services. No list of what the ethical aspects include is therefore given here.

Figure 11 summarizes the first three steps in applying the information quality analysis in the present dissertation.

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[5] Miles and Huberman (1984) also use the distinction between intellectual and physical
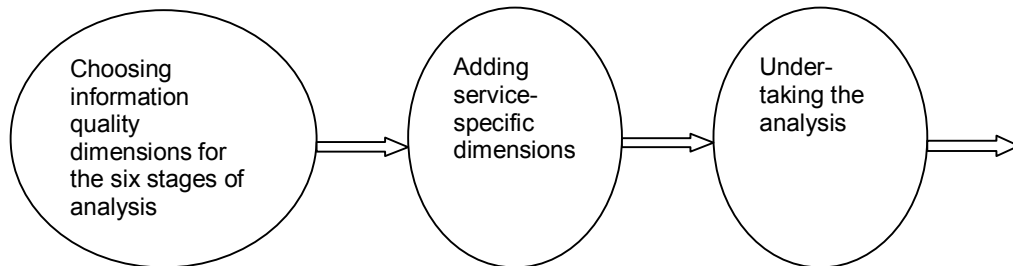
Figure 11. The first steps in applying the information quality analysis

5.1.1.4 Six stages of analysis

Stage 1:

Analysis of *basis* contains an investigation of the sources of different types of information. In the case of, for instance, customer information, a certain amount of basic information is given for the call centre's database when a safety telephone is first subscribed. This is usually done by filling in a form that contains details on who is subscribing (if different from the customer) and her/his contact information, the customer's contact information, the address for invoicing (if applicable, depends on the service environment), some space for additional notes, information on the condition of the customer's health, medication, technological aids (such as hearing aid), other related services (typically municipal home care) as well as near relatives and their contact information. These types of information are given by the customer only or by the person subscribing with /on behalf of the customer. Depending on the service system, the information may be supplemented by, for instance, municipal home care employees or telephone installers.

The quality dimensions utilized in the analysis of basis are relevancy, timeliness, completeness (dimensions of contextual information quality); accuracy, objectivity, believability (intrinsic information quality) and accessibility and security (accessibility information quality). The meaning of these dimensions is given in the chapter on results. The quality dimensions utilized in the different stages of analysis overlap in many cases, but it is argued that an artificial separation would lead to an incomplete and misleading picture. For those dimensions that are not discussed in detail in the text, definitions are given in Annex 2.

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accessibility in their discussion on validity in qualitative research.

Stage 2:

Analysis of *component* aims at finding out whether the right pieces of information are stored and transferred. This has to do with information quality dimensions such as relevancy, value added, timeliness, completeness and appropriate amount of information (dimensions of contextual information quality). If, again, the example of customer information is used, we can distinguish two different situations that place different demands. When an alarm call from a customer is received at a call centre, the right pieces of customer information to be transferred differ from those pieces that should /could be transferred when a new customer subscribes to the service, as background information to service providers – depending on demands for confidentiality and possible related expressions of consent by the customer.

Stage 3:

Analysis of *content and instrument* implies an investigation of whether the information in question is transferred in the right forms. Dimensions of information quality to be investigated in this context include accuracy, objectivity, believability, reputation (intrinsic information quality); interpretability, ease of understanding, concise representation, consistent representation (representational information quality) and ease of operation, traceability and flexibility.

Stage 4:

Analysis of *timing* focuses on whether the necessary information is available at the right moment. Timeliness and relevancy (contextual information quality) as well as appropriate velocity are the quality dimensions investigated.

Stage 5:

Analysis of *routing*, again, focuses on checking whether the necessary information is in the right places. Dimensions such as accessibility, security (accessibility information quality); relevancy, value added (contextual information quality) and traceability are utilized in this context.

Finally, *stage 6:*

Analysis of *processing procedures* is directed at investigating whether the information in question is handled in the right way. Accessibility (intellectual and physical), security (accessibility information quality); interpretability, ease of understanding, concise representation, consistent representation (representational information quality); traceability, cost-effectiveness, ease of operation, authority of person handling, appropriate

velocity and sustainability (costs and ethical aspects) are the dimensions utilized.

The information quality analysis framework of this dissertation is anchored in theory and practice but provides a novel and innovative way to assess information quality in complex environments as compared to earlier studies. Special weight is given in this dissertation to the usability and applicability of the framework. Before the presentation of the results of its operationalization, clarifications are still given in the following for how the 'analysis package' is undertaken in practice.

5.1.2 Undertaking the information quality analysis

5.1.2.1 Mapping of information flows

Figure 12 describes the whole research process following the selection of appropriate information quality dimensions for the investigation.

Before the developed framework of information quality analysis can be applied, a mapping of information flows thus needs to be undertaken to find out about:

- types of information that are transferred and stored,
- events (or types of information) that trigger an action or a process,
- which piece of information justifies which action,
- how an activity triggered by an event proceeds in the network (organization),
- bottlenecks of information flows,
- logic of the network (organization) in organizing information processes.
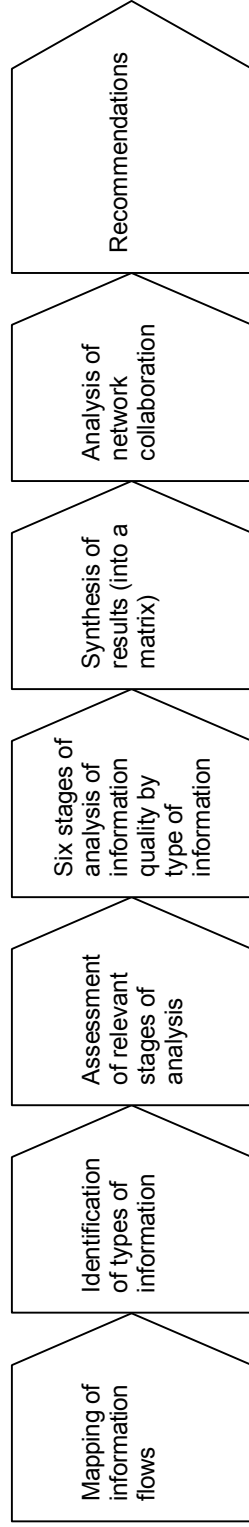
Figure 12. The information quality analysis step by step

5.1.2.2 Types of information within safety telephone services

Discussions on information processes within safety telephone services quite clearly centre round alarm information. The reason seems obvious – those information processes form the foundation for the service type in question. However, even safety telephone service professionals appear to concentrate overwhelmingly on alarm information, without giving the necessary attention to the other types of information.

Information being transferred within the safety telephone service networks can be divided into four types: customer information, information related to alarm calls, technical information and information related to collaboration network (see Table 8). Table 8 reports examples from interviews – not a general, ideal state of affairs. The requirements for the precise contents of the different types of information vary somewhat across the different types of networks – depending on their environment and operations. The rows and columns in Table 8 are not meant for comparison.

It needs to be emphasized that these were identified as the distinct types of information that are *transferred in the networks*. For instance, information that is given to the customer and near relatives at the time of installation of the safety telephone is of essential importance, but it is not transferred in the networks. Therefore, it is not included as such in the information quality analysis. In the analysis of network collaboration, however, this topic comes up.

Table 8. Types of information transferred within safety telephone service networks

Type of information	Examples
Customer information	Customer's contact information
	Condition of customer's health
	Customer's medication, technological aids (such as hearing aid), other related services (typically municipal home care)
	Near relatives and their contact information
	Changes in the information mentioned
	Expressions of consent regarding information transfer
Alarm information	Customer's name and address
	Reason for alarm call
	Basic information on customer's health
	Special remarks (e.g., especially poor hearing)
	Information on near relatives if they should be informed in case the customer is hospitalized
	Information on visits and actions by safety helpers
Technical information	Broken appliance
	Need to change battery of appliance
	Disconnection and connection of appliance
	Service needs related to, e.g., thunderstorms
Network information	Organization of operations
	Changes in organization of operations
	Contact information of collaborators and changes in it
	Feedback from customers
	Feedback from collaborators

Comprehensive frequency data on the transfer of different types of information within safety telephone services are not available for any of the case networks. It can be estimated that there are differences in the

transfer of (i) customer information and (ii) information related to collaboration network. The importance of transferring the latter kind of information namely depends on the type of network. For instance, in an internal system of a block of service flats, the personnel knows the customers and deals with alarm calls, so there is no need to transfer network information – nor customer information, for that matter.

Detailed survey data are available on the reasons for incoming alarm calls for one of the case networks. Those are cited here to give an idea of the percentages of typical reasons. The figures can be considered fairly representative for safety telephone services in general. Altogether 759 alarm calls that came into a company-owned call centre during three days in the autumn of 2002 were investigated to find out about their reasons and the actions taken at the call centre. As many as 80 per cent of these alarm calls were related to technical faults, needs to change batteries, test alarms, needs to have social contact, causeless alarms and false alarms (Table 9). These usually do not lead to sending help to the customer. (Molander, 2003.)

Table 9. Summary information on the survey results
          Source: Molander, 2003

General type of reason	Reason for alarm call coded as:	Share (%)	Total by general type of reason (%)
Need for physical help	Immediate need for help (various reasons)	13.3	20.3
	Waiting for help (regular home help visit)	3.7	
	Repeated alarms (expecting the help promised)	3.3	
Technical alarms	Technical faults	2.4	45.7
	Battery alarms	34.2	
	Test alarms	9.1	
Other (*)	Needs to have social contact	1.2	34.0
	False alarms	5.9	
	Causeless alarms	26.9	

Notes: (*) Boundaries of the types and coding practices were found to be unclear.

In only 0.4 per cent of the cases, the person in charge at the call centre got in contact with the regional emergency centre (governmental) and called for urgent ambulance transportation. Other kinds of helpers were called for in 14.3 per cent of the cases (such as non-urgent ambulance transportation, visiting nurse, home help, personnel at a block of service flats, night patrol or near relative). (Molander, 2003.)

5.1.2.3 Identification of relevant stages of analysis

In a network environment, taking into account different types of networks and different types of information may lead to chaos in the application of the information quality analysis framework, unless the investigation is further systematised beforehand. This systematisation is, again, an iterative and cyclical process based on an understanding of the service branch in question, study visits and interviews. The systematisation is proposed to be done by assessing the relevance of each of the six stages of analysis by network and by type of information (Table 10). Weighting is based on the interview data, but it is not a mechanical process for which numerical criteria could be shown.

The starting point remains that all six stages are undertaken. Exluding some stages in the case of, for instance, technical information is not contradictory to the intention to investigate information *processes*. The systematisation simply shows which analyses are meaningful. For instance, an analysis of basis (the sources) is not meaningful with regard to technical information. Information on a broken appliance is relayed automatically – or sometimes by the customer, a near relative or a municipal care professional visiting the customer. There does not seem to be anything problematic in the sources of such information, in any kind of a network.

The assignments for Table 10 were relatively easy to do on the basis of the interview data and other knowledge of the branch of safety telephone services. It was especially clear when a stage of analysis was not at all applicable (0) or when it was applicable and of particular relevance (3). Knowledge of the characteristics of the networks and their information flows was assessed together with the interview data. Going through the reasons for the assignments by type of network and type of information would result in a very detailed and long explanation with many practical examples – which then would overlap with examples given in the actual

analysis. Suffice it to give the above example of analysis of basis versus technical information.

In the present dissertation, the amount of data is so large that a prior systematisation has to be made before the analysis. When applied in an individual organization, irrelevant parts of the information quality analysis framework could be identified in joint discussions without anyone filling in a table first. Even there, however, a similar matrix to that in Table 10 could be developed by unit or department – particularly in bigger organizations.

Development of a matrix can also help in giving the appropriate weight to the different types of information that are transferred. Certain types may be seen as self-evident and omitted in planning, although they contribute to the transfer of other types of information. In companies, the different types of information are perhaps easier to identify, and employees may be more knowledgeable about them (cf. Huang, Lee and Wang, 1999). The present dissertation shows that it is not likely in heterogeneous service networks such as those investigated here.

Table 10. Relevance of analyses by type of network and type of information

Type of network	Type of information	Analysis of basis	Analysis of component	Analysis of content and instrument	Analysis of timing	Analysis of routing	Analysis of processing procedures
Nation-wide network (company operated) (1)	Customer	3	3	2	2	3	3
	Alarm	0	3	3	3	3	3
	Technical	0	0	0	3	2	0
	Network	2	3	3	3	3	2
Municipal network (3)	Customer	2	3	2	2	2	3
	Alarm	0	3	3	3	3	3
	Technical	0	0	0	3	2	0
	Network	2	3	3	3	3	2
Block of service flats (cooperative or foundation operated) (2)	Customer	1	2	2	2	2	2
	Alarm	0	2	2	2	2	2
	Technical	0	0	0	2	2	0
	Network	1	1	1	1	1	1
Private customers (non-governmental organization operated) (1)	Customer	3	3	2	2	2	2
	Alarm	0	2	3	2	2	2
	Technical	0	0	0	3	2	0
	Network	1	2	2	2	2	2
Pilot project (1)	Customer	3	3	2	2	3	3
	Alarm	0	3	3	3	3	3
	Technical	0	1	1	3	2	1
	Network	2	3	3	3	3	2

Notes:

Weighting: 0 = Not applicable. This stage of analysis is not applicable to this type of information.
1 = Applicable but of lesser relevance.
2 = Applicable.
3 = Applicable and of particular relevance.

Table 10 implies that differences in relevance mainly depend on the type of information. There are not many differences in this regard between the different types of networks within safety telephone services. This finding was confirmed by the interview data. The only environment with clear differences was blocks of service flats.

After thus identifying the natural restrictions, the actual analysis on the basis of the framework could start. The core of the information quality analysis framework contains the six stages of analysis:

1. basis – the right source of information,
2. component – the right piece of information,
3. content and instrument /means – in the right form,
4. timing – at the right moment,
5. routing – in the right place,
6. processing procedures – handled in the right way.

The six stages of analysis were undertaken with the help of the information quality dimensions chosen.

In addition to its core – the six stages of analysis – the information quality analysis contains a larger structure including

- an investigation of network collaboration as a facilitator of management of information quality and
- preparation of practical recommendations for the service branch in question.

These were undertaken after the six stages of analysis. Figure 12 summarized the structure of the entire information quality analysis in the present dissertation.

5.1.2.4 Network collaboration as a facilitator of management of information quality

As noted by Benassi (1993), network studies require a more holistic approach than just a review of alliances or partnerships of single organizations. In the present dissertation, the network collaboration perspective complements the information quality perspective. The semi-structured interviews were directly interlinked to the network perspective. The intention with the analysis and presentation of results on network

collaboration is to utilize all the data that have been collected – as fully and efficiently as possible. Network collaboration is also regarded as a prerequisite for improvements in information quality within safety telephone services – a facilitator of management of information quality.

After the analysis of information quality with the framework developed, the interviews were reanalysed to gain additional understanding. This was mainly done through mind-mapping techniques. A corresponding methodology has been utilized by, for instance, Viitanen (1998) in a study of information management strategies in a global network organization. Quotations from interviews are included in the presentation of the results – as in the presentation of the results on information quality. They are felt to reflect the richness of the data.

The investigation of network collaboration is deliberately not as structured as, for instance, social network analysis (e.g., Wasserman and Galaskiewicz, 1994; Scott, 2000), due to its complementary character in relation to the operationalization of the information quality analysis framework – the main part of the present dissertation.

5.2   Results of the information quality analysis

5.2.1   Courses and bottlenecks of information flows

The Finnish nation-wide network is focused on in the description of the results. Results of the other network contexts are brought up for comparison where there are significant differences or notes to be made. A discussion of all the networks one-by-one would lead to considerable repetition. Results concerning the nation-wide, biggest network are based on the most comprehensive data. These data also have the highest reliability and validity.

Figure 13 illustrates flows of customer information within one city of the nation-wide safety telephone service network. Figure 14 describes flows of alarm information within the same city. Figure 15 shows flows of technical information, and Figure 16 flows of network-related information within the city in question. The basic figure is the same each time, but the flows and arrows vary. Readers can thus also look at them side-by-side and perceive the complexity of the network and information flows in just one locality of a big network. The figures are structured around the call

centre – not the customer – to highlight the organizational network perspective.

The net of information flows is quite complicated even in only one locality. If the call centre is large and serves numerous localities, challenges are multiplied. Presenting the four figures for all the 11 localities within the largest network as well as for the other seven networks is not meaningful even in annexes. Figures 13–16 illustrate the results of the mapping of information flows. They are thus summaries and overviews of numerous different kinds of information flows. They are complemented with a written description of the results, based on the interview data from the city in question.

5.2.1.1 Customer information

When a new customer wishes to subscribe to the service privately, the local contact person of the call centre company visits the customer-to-be to fill in the customer information form together with her/him. The form is sent by fax to the call centre, and a copy is kept in the local contact person's files (Figure 13). When the municipal authorities subscribe to the service for their customers, they provide the customer information. The information is often supplemented in the customer's home at the time of telephone installation.

Customer information is later exchanged – as the need arises – between the home care/ night patrol staff (operated by a non-governmental organization) and municipal home care staff. Meetings are rare; two or three per year may be arranged, but telephone conversations are more typical. The municipal authorities receive quarterly reports, where also the number of private customers and information on visits by safety helpers in their homes are given.

Written instructions to customers that are given at the time of telephone installation include guidance on how to inform about changes in customer information (changes in any information on the customer her/himself, change of locks or changes in contact information of near relatives). Notifications of changes are received by both the local contact person and the call centre. In the locality in question, near relatives were said to be active in notifying of changes, even of changes in customers' health condition.
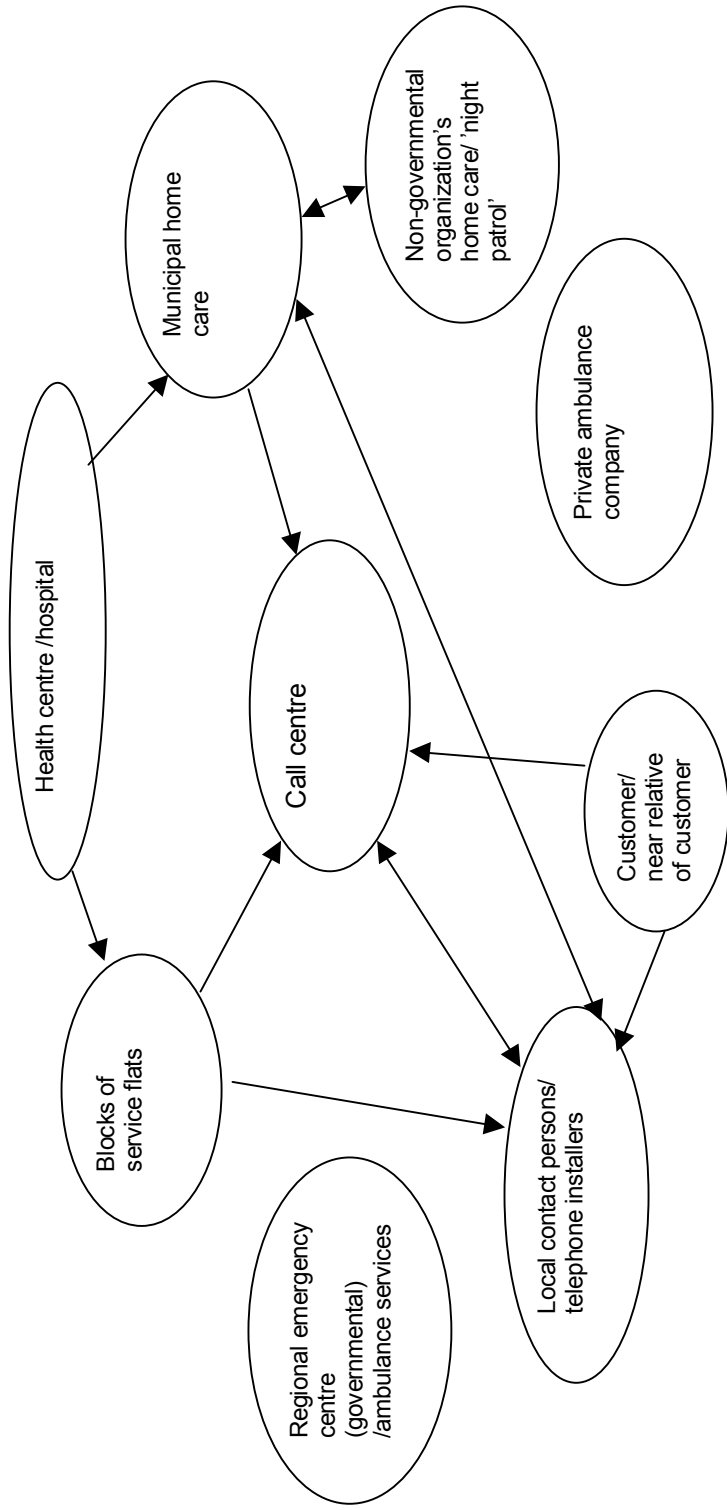
Figure 13. Flows of customer information within one locality of the nation-wide safety telephone service network

A special case of exchange of customer information between the municipal authorities and home care/ night patrol staff (of a non-governmental organization) takes place when consultations are held on an aged person's ability to continue living at home.

In a block of service flats, when a new inhabitant wishes to get a safety telephone, customer information is provided by the staff of the block of service flats to the local contact persons. Changes in customer information are only notified if the customer moves to another flat within the block. Changes in customers' health condition are not notified, as there are usually so-called care files in writing in customers' homes, and up-to-date information could be found there. This does not, however, help the call centre and network collaborators in interpreting alarm information.

The practices described above are typical for networks other than *internal* safety telephone systems of blocks of service flats. In the locality in question, bottlenecks in customer information flows were found particularly in

- flows of information on changes in customer information (that have been notified by the customer or a near relative according to the instructions) to all the relevant partners in the local network,
- flows of information on changes in customers' health condition.

5.2.1.2 Alarm information

For those customers who have got a safety telephone from the municipality as part of public service provision, safety helpers during the day and in the evening are local municipal home helps (Figure 14). They are called out to help by the call centre. There is one number for each area of the city that the call centre always calls to reach the home helps. Alarm calls of the municipal customers are relayed at all hours first to the call centre. If the customer so wishes at the time of subscribing to the service, the call centre first calls out the customer's near relatives. If they do not answer, professional helpers are called out.

For the private customers, safety helpers come from home care services operated by a non-governmental organization. They are called out by the call centre. There is also a private ambulance company on call – they can act as substitutes if the normal safety helpers are unable to go due to, for instance, multiple simultaneous alarms.

Sometimes alarm information comes through the regional emergency centre. Customers may call the regional emergency centre instead of the safety telephone call centre. In such cases, if the regional emergency centre knows about the customer's safety telephone, they may call out the safety helpers to open the door.

Relaying of alarm information was found to be well planned and relatively clearly known by all the collaboration partners – as could be expected on the basis of the central role of this type of information. Interestingly, information on visits and actions by the safety helpers also appears to be transferred efficiently. It is even monitored on a regular basis in the city in question. Such practices were found to be rare as compared to other localities and networks. It seems that possible factors contributing to this favourable situation are (i) particularly active and well-informed local contact persons and (ii) awareness and interest towards safety telephone services among supervisory municipal home care staff.

5.2.1.3 Technical information

Flows of technical information are relatively straightforward (Figure 15). If an automatic technical alarm is received, the call centre relays the information to the local contact persons or telephone installers, municipal home care staff, home care services of the non-governmental organization or personnel of the block of service flats in question. Depending on the reason for the technical alarm and hour of the day, assistance is provided by different professionals.

5.2.1.4 Network information

Network information flows centre round the local contact persons, the call centre and municipal home care (Figure 16). Municipal contracts concerning purchase of services from the call centre company and its local contact persons guide part of the flows of network information, as they contain provisions concerning communication and reporting. The local contact persons receive sporadic network information from the call centre. Among the other actors in the city in question, flows of network information take place, but they have not been defined in a systematic manner.
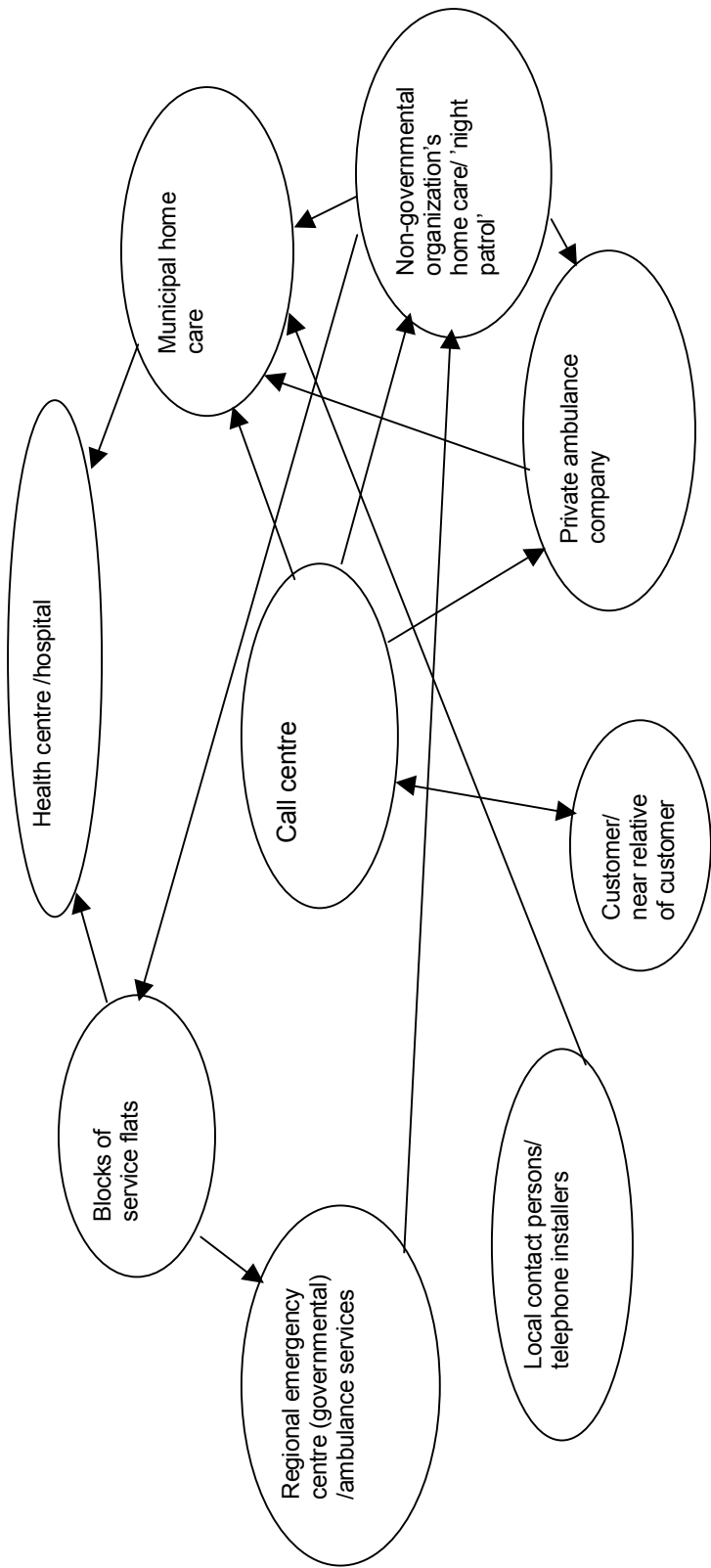
Figure 14. Flows of alarm information within one locality of the nation-wide safety telephone service network

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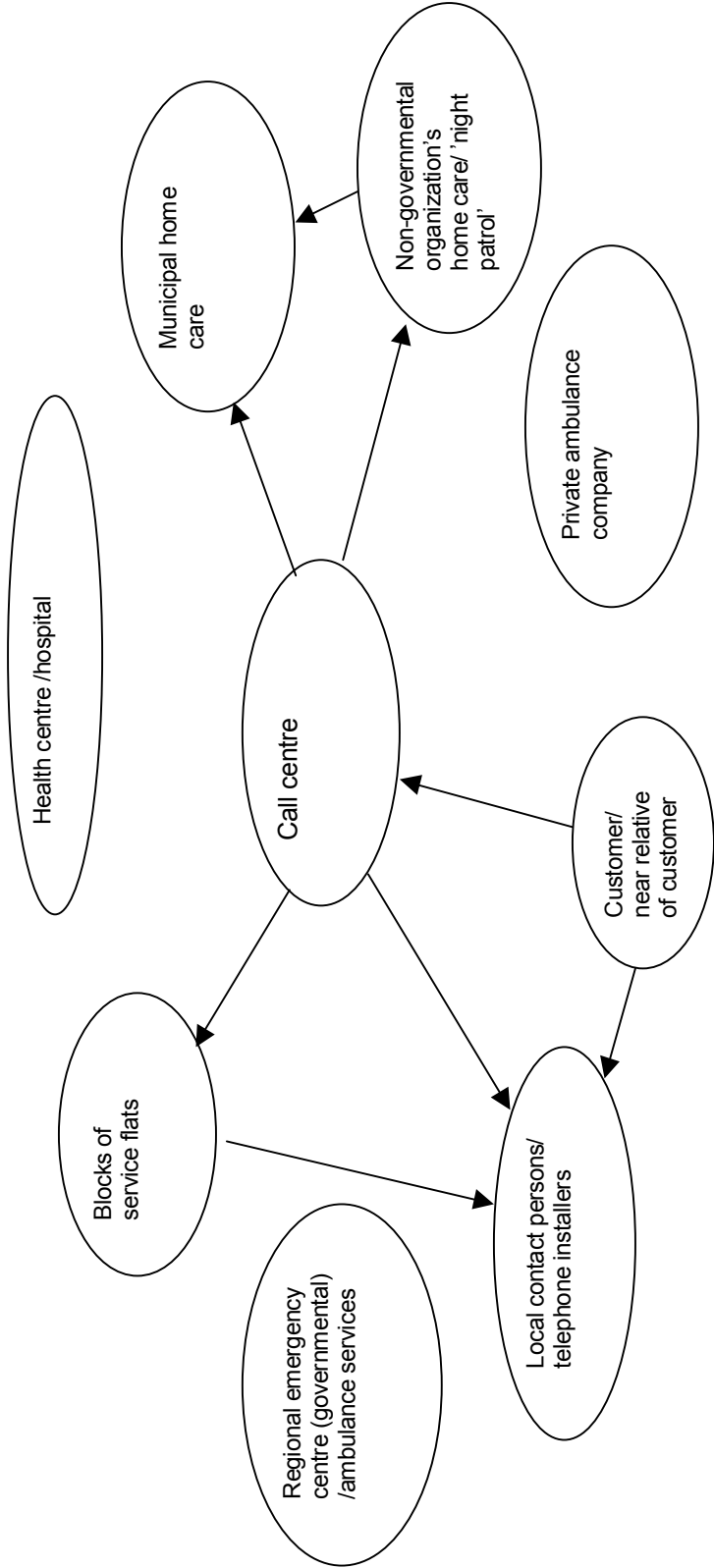
Figure 15. Flows of technical information within one locality of the nation-wide safety telephone service network

Municipal home care

Non-governmental organization's home care/ 'night patrol'

Private ambulance company

Health centre /hospital

Call centre

Customer/ near relative of customer

Blocks of service flats

Regional emergency centre (governmental) /ambulance services

Local contact persons/ telephone installers
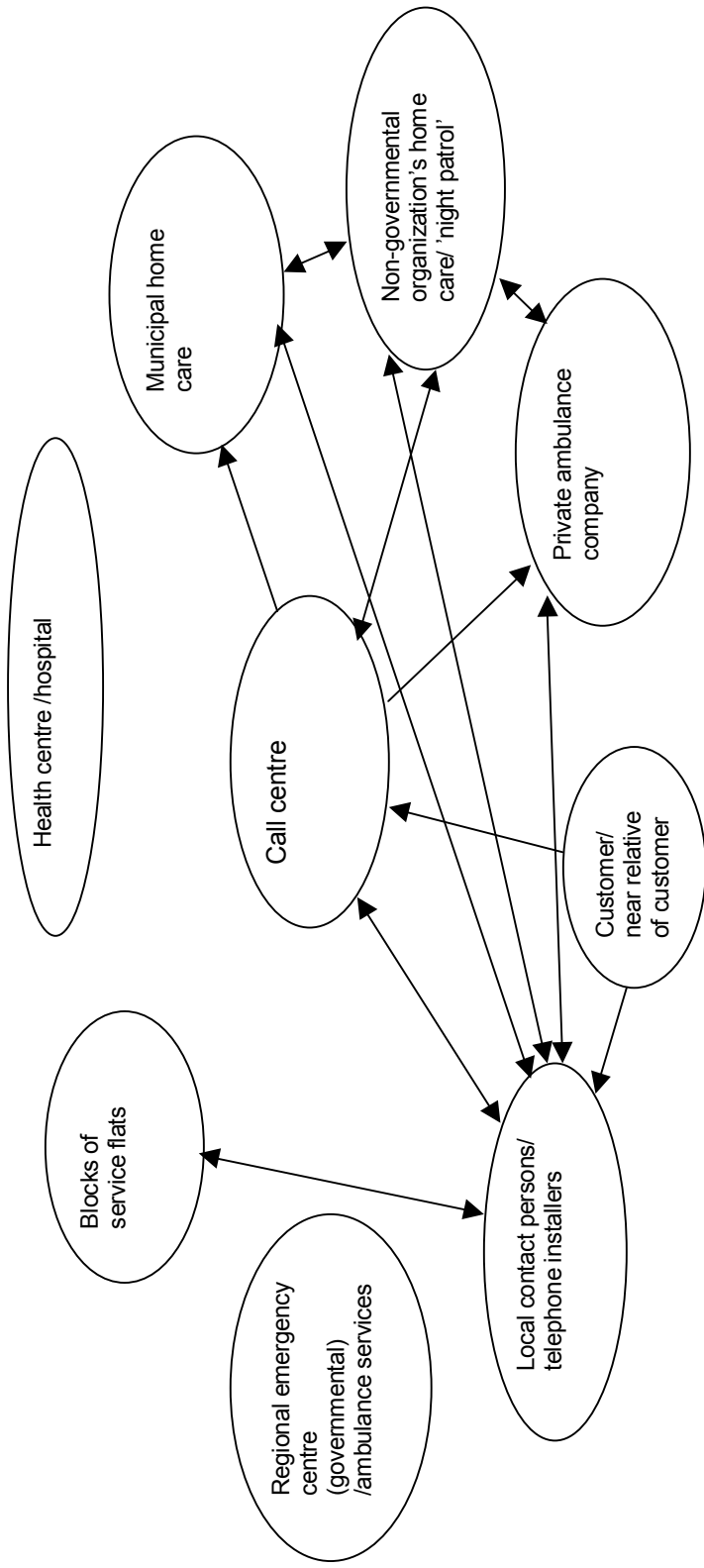
Figure 16. Flows of network information within one locality of the nation-wide safety telephone service network

5.2.1.5 General remarks on courses and bottlenecks of information flows

The service structure was found to be somewhat different in every locality. It is different in every locality of the nation-wide network as well as in comparison to – and among – the other networks. The call centre may have fewer collaboration partners than in Figures 13–16, for instance in small towns or in the countryside, or in the special environment of internal safety telephone systems of blocks of service flats. Whatever the type of network or locality is, each arrow between two actors was found to be a potential bottleneck. Absence of an arrow between two actors may also be a sign of a bottleneck, but that is not always the case. Given the typical problem of information overload, transfer of unnecessary information also needs to be avoided.

Even if practices were relatively clearly defined and instructed with regard to, for instance, routing and processing procedures of technical information flows, problems in their timing were identified. This highlights the importance of a detailed investigation of information quality in different kinds of information processes.

Figure 17 gives examples of alternative service chains of a safety telephone service customer in one locality, when she/he gives an alarm to the call centre. Bottlenecks in the flows of all four types of information were found to be related to the following general factors: lack of a well-defined 'methodology' for information processes, differences in local service structures, differences in service provision depending on time of the day, collaboration between the public, private and third sector service providers as well as the quality of the information.
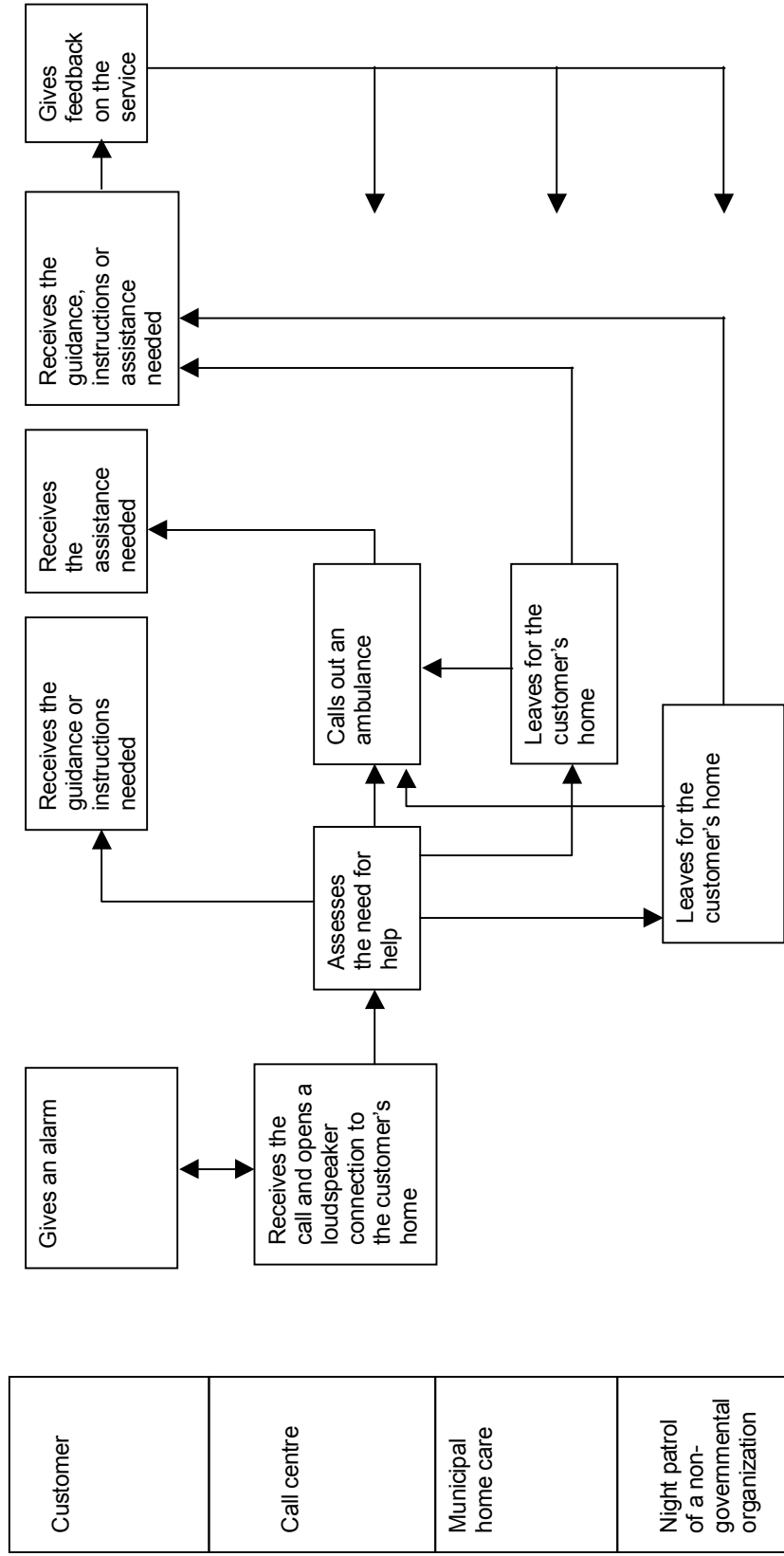
Figure 17. Examples of alternative service chains of a safety telephone service customer in one locality

Local conditions thus shape the service provision. The fact that there are as many parallel systems as there are localities was found to make it challenging for the nation-wide network to develop the operations towards greater systematisation and coherence. This issue is intertwined with challenges of overall virtual network management. Differences in local conditions concern the type of customers, who may have subscribed to the safety telephone and service individually, at their own expense, or who have obtained the service through the municipality as part of public service provision. The type of customers – private or municipal – was observed to affect transfer of customer, alarm and network information between service providers as well as the extent of integration of safety telephone services into the whole 'service package' of the individual ageing person.

Local conditions also have an impact on who provides the actual help to the customer (municipal home help or a company providing home care, inter alia) and who is responsible for the installation of the telephone in the customer's home and the related guidance on how and when to use the telephone. The moment of installation was found to be essential to the success of safety telephone services from the points of view of both the customer and the service network. The interview data showed that clear procedures for guidance provision were lacking. Local conditions affect service provision also as those in the countryside were found to get service that is different from the services of those living in towns and cities.

Time of the day when an alarm call is received was observed to lead to differences in service provision. For instance, within one city, one day is divided into six periods of different length, and service provision to the customer is organized differently during each of these periods. This was shown to exacerbate problems with regard to management of information flows. Bottlenecks were observed in flows of customer, alarm and network information. They had an impact on customers' service chains, service quality and work at the call centre.

The interview data showed that bottlenecks in information flows are partly related to the 'multipolarity' of collaboration networks. Collaboration between public and private actors within the social and health care sector is still taking shape in Finland – not only in the sphere of safety telephone services. In many cases, procedures for the collaboration were found to remain unclear within safety telephone services. Different organizational cultures in, for instance, companies and municipal home care units also

seem to hamper collaboration. Challenges related to financing the public sector social and health care in an increasingly ageing society appear to render the work of the professionals of the field difficult.

The interview data also showed that the lack of established procedures makes contract negotiations demanding – municipalities do not necessarily know what they need, and companies may not know what kinds of 'service packages' to offer. Contract provisions were found to have a significant impact on information flows – they either facilitate information flows or cause extra bottlenecks. Non-governmental organizations and cooperatives also add their own flavour to the multipolar networks. These observations are not applicable to all the networks investigated, however. Internal safety telephone systems of blocks of service flats as well as purely municipal systems in small or medium-sized towns do not encounter similar problems.

A very important factor related to courses and bottlenecks of information flows was found to be the quality of information itself. Improvement of information quality was found to require systematic attention to the content of information that is transferred and stored. A thorough assessment had not been made of what kind of customer, alarm, technical and network information is needed – and of the necessary degree of accuracy of each piece of information. For instance, the interviews indicated that problems are typical in the area of telephone numbers of service providers, near relatives of customers and of customers themselves. They were found to be pieces of information that must be error-free within safety telephone services. In some other pieces of information, again, minor inaccuracy might be acceptable.

Some bottlenecks with regard to alarm information were also identified. The network information needs of all collaboration partners of the networks were observed to be rather poorly met, particularly in the nation-wide network. Plans to fulfil those needs had not been made and implemented. This is an important finding, because smooth flows of network information were found to be closely related to flows of other types of information – in particular, customer and alarm information. The quality of information also needs continuous control after improvements have been made. This became clear in the interviews – in the discussions on improvements that had already been made.

5.2.2 Operational logic in arranging information processes

The nation-wide network

Operations of the biggest safety telephone service network have expanded in recent years. The number of customers has risen, and operations have started in new localities. Information processes have been arranged with one locality at a time. The interviews revealed that problems and challenges related to information flows and their management are well-known at the practical level. However, the issue has not been addressed in a systematic manner – by defining procedures, rights and responsibilities with regard to information, by finding out information needs of collaboration partners and professional groups as well as by giving attention to the quality of information. Thus, the interviews indicated that a coherent operational logic has been lacking in the arrangements concerning the network's information processes.

Many of the shortcomings were found to have their basis in the complex operational environment of the big network. The core of the network – the company operating the call centre does not have authority over the heterogeneous network participants but is itself a service provider towards, for instance, municipalities. Yet, in its operations, the company was observed to be highly dependent on services produced by municipalities and other collaboration partners. The interview data showed that in this situation, the company operating the call centre has a very demanding task in managing its collaboration network. It is argued that such a situation differs significantly from, for instance, sub-contracting networks of the manufacturing industry.

Other networks

Direct comparisons between the case networks are misleading, as there are major differences in their operational environments. Operational logic in arranging information processes seemed to be lacking in most of the networks. It appears that the importance of information-related issues in safety telephone services is recognized, but the area is also felt to be difficult to grasp and to address in development efforts. Information processes have usually been arranged on an *ad hoc* basis.

A glaring exception was a big municipal network in which there was a clear logic concerning, for instance, feedback processes and orientation

of private collaborators into the network operations. The challenges of this network differ somewhat from the nation-wide network, because its operations concentrate in one big city. Still, it appears that it has succeeded especially well with regard to information-related matters and network collaboration.

5.2.3 First stage of the operationalization: Analysis of basis

In the following, empirical results are presented of the operationalization of the framework of information quality analysis – from the analysis of basis (sources of information) to the analysis of processing procedures. Semi-structured interviews around themes such as information transfer and network collaboration were found to be a good way to obtain the data for the analysis, as the interviewees were not familiar with the various concepts related to information quality.

Table 11 includes the list of analyses that are excluded in the present dissertation due to their irrelevance for safety telephone services. It is a summary of Table 10.

Table 11. Analyses that are excluded in this dissertation

Stage of analysis	Types of information excluded
Basis	Alarm and technical information
Component	Technical information
Content and instrument	Technical information
Timing; routing	None
Processing procedures	Technical information

In accordance with the practice adopted earlier in this dissertation, in the following, the results are presented focusing on the nation-wide network. The other network environments are briefly commented on if significant differences were observed.

5.2.3.1 Customer information

Within the analysis of the sources of customer information, the quality dimensions investigated were relevancy, timeliness, completeness, accuracy, objectivity, believability, accessibility and security. Their definitions are as follows (Wang and Strong, 1996):

- relevancy (the extent to which information is applicable and helpful for the task at hand),
- timeliness (the extent to which the age of information is appropriate for the task at hand),
- completeness (the extent to which information is of sufficient breadth, depth and scope for the task at hand),
- accuracy (the extent to which information is correct, reliable and certified free of error),
- objectivity (the extent to which information is unbiased – unprejudiced – and impartial),
- believability (the extent to which information is accepted or regarded as true, real and credible),
- accessibility (the extent to which information is available or easily and quickly retrievable),
- security (the extent to which access to information can be restricted and hence kept secure).

Table 12. Coding of the interview data: Themes related to the quality dimensions in the interview data

Relevancy	Timeliness	Completeness	Accuracy
applicable, relevant, interesting, usable	up-to-date	breadth, depth, scope	accurate, correct, reliable, precise
Objectivity	**Believability**	**Accessibility**	**Security**
unbiased, objective	believable	accessible, available	information is of a proprietary nature, secure

Table 12 illustrates part of the coding system of the interview data. It was elaborated with the help of Wang and Strong's (1996) work – it was useful to see how they grouped initial information quality attributes under fewer information quality dimensions. In addition to the results based on the

coded data, many descriptive direct quotations are included in the following. Percentages for responses and results are not given, because

- firstly, it was sometimes questionable how the interview data should be placed under the different quality dimensions – there may be some overlap,
- secondly, giving figures would be misleading for the networks other than the nation-wide network, as the numbers of interviews were much lower.

It is argued that the overlap mentioned above does not reduce the value of the framework of analysis – rather, it contributes to utilizing the qualitative interview data as fully as possible. Relevancy is here discussed together with completeness – and believability together with objectivity.

Timeliness

Timeliness of the basis of customer information was found to require particular attention in safety telephone services. The basis of customer information is here understood as databases at call centres or corresponding units that answer alarm calls. The results showed that in large service systems, where each individual customer cannot be known, updating and supplementing customer information would be important. Ageing people's health condition may change quickly, and certain changes – for instance, if dementia comes out – even make the use of safety telephones difficult, if not impossible. Other types of information also change, such as telephone numbers of near relatives. The results indicated that these are not kept systematically up-to-date.

> *When the subscription is placed, the customer information is given on the form that is filled in. Changes have not, indeed, been communicated to the call centre. […] We could have improved our practices there. There may be customers who do not get any type of service other than this safety telephone service … if [the safety helper] does not know [the customer] and [the customer] has, for instance, a low blood sugar level – that the helper knows how to act… (Employee of municipal home care service, nation-wide network.)*

The age of customer information may be from the time of subscription to the safety telephone, which may have taken place years ago. The results

showed that procedures for updating and supplementing customer information have usually not been defined or are not sufficiently clear to the personnel. In one of the bigger networks investigated here, there is a system where the customers' files are regularly checked and subscriptions renewed once a year. In another, smaller network, updates of information on customers' medication are systematically and regularly asked for, but the customers rarely return the form.

Timeliness of the basis of customer information was shown to have a different weight in different kinds of networks (see Table 10). In internal safety telephone systems of blocks of service flats, timeliness of the basis of customer information was found to have a relatively small weight, as the personnel who helps the customers knows them. The results indicated that in a municipal system, again, collaboration partners sometimes benefit from access to other databases with up-to-date health-related information on the customers (for instance, databases of hospitals or health centres).

Completeness

The results showed that the extent to which the basis of customer information is of sufficient breadth, depth and scope for the tasks within safety telephone services varies between networks. The type of the network was found to affect requirements for customer information, as noted above in the context of timeliness. This might seem self-evident, but the results indicated that this important effect is not recognized very clearly among the practitioners. It was also found out that within the nation-wide network, customer information is collected with slightly different kinds of forms in different localities.

The results showed that the challenge is to give precise definitions for which pieces of information are needed within the safety telephone service network in question. Any experienced call centre employee or service provider is likely to have an understanding of the necessary pieces of information. The results showed that such an understanding is not necessarily fully or even well reflected in the structure of the subscription form that a customer fills in – or in the structure of the database of customer information. That kind of correspondence seems to depend on how systematically information-related matters are handled in the network.

It is, of course, also necessary to ensure that no customer information is collected if it is not utilized. This is related to relevancy, the extent to which information is applicable and helpful for the task at hand. Relevancy of customer information was not found to be a problem in the networks investigated in the present dissertation.

Accuracy

Accuracy, the extent to which the basis of customer information is correct, reliable and certified free of error, is closely related to timeliness and completeness. However, the results showed that ensuring that customer information in databases is certified free of error is an especially difficult task within safety telephone services. The interviews indicated that, for instance, telephone numbers of customers, near relatives and service providers are elements of customer information that should be certified free of error within safety telephone services. These persons all have to be reachable by telephone without delays or mistakes, but the results showed that problems in this area are quite typical.

> *We do change telephone numbers daily, and I could say that we have quite a list of incorrect telephone numbers everywhere. That is an unfortunate fact that people do not [remember to inform of changes] … sometimes there are such awful situations… (Representative of a governmental regional emergency centre clarifies problems with telephone numbers, nation-wide network.)*

On the other hand, it can be speculated that if the address for invoicing (if, for instance, a near relative pays) is slightly wrong, the invoice is likely to find its way to the payer any way. If it does not, the payee will find out the correct address in due time, and the quality of the care provided to the customer does not suffer.

The results also showed that practices to ensure accuracy are very varied if procedures are not clearly defined. Despite unclear procedures, changes in, for instance, telephone numbers may – for some time – be relayed without major problems to, at least, part of the network. Recruitment of new personnel or other such reason is then likely to accentuate the impact of unclarity in procedures, which is also reflected in the following quotation from an interview.

[Changes of customers' telephone numbers are relayed] mainly via the municipal home care service. Home helps visit the customer often … so through them, the message is relayed to home care supervisors, and then to me from them. But I have also done so that I have given my own telephone number to the customers, so that they can call me directly. Or then they can call from the safety telephone to the call centre… It depends a little, but usually messages come from the municipal home care service. (Local contact person/ safety telephone installer, nation-wide network.)

It was found out that there are cases in which a customer has informed of a change in her/his customer information to the nearest contact persons, who have then relayed the message forward to the call centre in another city, but the changed information has not been relayed through anyone to municipal authorities and safety helpers – the whole of the necessary collaboration network.

The results also showed that the triumphal diffusion of mobile phones affects the accuracy of customer information within safety telephone services:

[If telephone numbers of customers' near relatives are changed, the message is not relayed through municipal home care.] Probably, the relatives inform of the change or the customer does. [...] That could actually be quite necessary, and nowadays, the age of mobile phones is rather short, too, so the number may change, or it may change through change of operators. That should certainly be taken into account from now on [...] (Employee of municipal home care service, nation-wide network.)

A special case related to accuracy of the basis of customer information is changes of locks in customers' homes. The 'key base' with customers' keys could be characterized as part of the customer information database for the purposes of the present dissertation. The results showed that changes of locks are not usual. Particularly in small towns and in the countryside they are rare, but when they do take place, they are not communicated.

Perhaps the most problematic is this change of locks, people do not necessarily understand that it should be told, too, and that keys should be changed. Somehow, it is not … I remember that once locks had been changed in a whole block of flats, and it was found out just by accident that this had taken place. And fortunately, nothing had happened to anyone. […] Near relatives are not necessarily aware of the importance of

informing, either. (Employee of municipal home care service, nation-wide network.)

Objectivity and believability

Objectivity (the extent to which the basis of customer information is unbiased – unprejudiced – and impartial) and believability (the extent to which information is accepted or regarded as true, real and credible) call for few comments. Within safety telephone services, they were not found to cause problems other than those that belong more naturally under the other dimensions discussed.

Accessibility

Accessibility, the extent to which information is available or easily and quickly retrievable, is in the context of the sources of customer information related to who is capable of giving, updating or supplementing customer information.

The results showed that there are many questions to be asked with regard to accessibility. For instance, if a customer suffers from a beginning dementia but is still able and willing to use a safety telephone, and a municipal home care officer takes care of the subscription on her/his behalf, does the officer have all the information that is needed? If a near relative subscribes, does she/he have all the information needed? If the customer is in good health and takes care of the subscription her/himself, how is it ensured that she/he gives all the relevant information on her/his health condition, medication, other closely related services or near relatives? The results indicated that customers may have various reasons for not disclosing even relevant information – such as suspiciousness.

Additional questions are: Which procedures does the call centre or service providers follow if necessary information is missing or cannot be easily and quickly retrieved? Have the procedures been defined for different types of missing information, or has lack of action been justified? The results showed that in one of the networks, lack of action has been justified with the principle that customers have the right to give the amount of information they wish.

Some of these questions are such that there are no obvious answers, but they still need to be asked and considered. The results also showed that all collaboration partners in the networks are not necessarily aware of the possible effect on the services of how customer information is given, updated and supplemented.

Some network partners, on the other hand, were well aware of the effect on the services and knew how they can contribute to improvement of the basis of customer information. It was found out that customer information is sometimes supplemented in an important way by, for instance, telephone installers:

> *[After the installation] I inform by phone if, for instance, the customer's hearing is very poor – if 'poor hearing' is noted in the customer information form only as a secondary remark. But I can call and let the call centre know later that it really is so – that they would pay more attention to that fact if an alarm comes in. (Local contact person /telephone installer, nation-wide network.)*

> *The subscription is normally placed by, for example, a near relative, so she/he is the one giving the information on the customer. But obviously, when we go to the customer's home, there is the customer, too. So, the customer information may be supplemented somewhat there, during the visit. (Telephone installer, nation-wide network.)*

Security

Security with regard to the sources of customer information has to do with the major issue of confidentiality of health-related information.[6] The results implied that the issue of consent management is central within safety telephone services. There are many types of public, private and third sector actors especially in large networks, and certain types of customer information may be transferred only with the consent of the person concerned. In smaller networks, this is not a big issue. Within the nation-wide network investigated, the only piece of customer information to which consent had been asked for is whether near relatives should be informed in case of a customer's hospitalisation.

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[6] A description of the Finnish legislation and regulations on this issue is beyond the scope of the present dissertation.

The results also implied that expressions of consent could be utilized in a much more efficient manner than is done at present to smoothen the problematic but essential information flows within large networks. This is further elaborated in the chapter on conclusions. The results indicated that such practices would contribute to greater coherence in the services.

The results further indicated that all the appropriate actors within safety telephone service networks should have the possibility to obtain basic information about their customers. At present, this is often not possible, particularly in big networks. Even in smaller networks, relaying of basic customer information until the last link of the customer's 'help chain' is often unsecured.

It was found out, for instance, that within the nation-wide network, a company that sells and rents out safety telephones does inform the municipal authorities of entry of new private customers into the sphere of the services, but the safety helpers responsible for night time help – who again are from a care service cooperative – do not get this information from the municipality. They do not get this information from anywhere else, either, which leads to the following kinds of undesirable situations.

We have no information whatsoever on the customers whose homes we go to. We then start by asking them about anything and everything they can tell us. We know nothing about illnesses, nothing about medication – we know nothing. […] It hampers the work greatly, because assessing the situation is then always difficult, when you do not know if the customer is a diabetic or something else – you have to rummage about in accessories, papers, anything, to find out what the person's illnesses are. […] We basically realize that there is a new customer, when she/he has given an alarm, and we are called out to help in a place new to us. (Night time safety helper/ care service cooperative, nation-wide network.)

All the examples are not equally extreme but along the same lines. The lack of customer information may lead to serious defects in service quality.

If we are called out to help a customer for the first time, and we think that she/he is in need of hospital care or surveillance, and then [when an ambulance comes] I am asked how the customer is normally – as she/he is a first-timer – and if I know anything about the background [and I don't]… well, it is so that ambulances do not take the customer to transportation to hospital then. When there is only the information about

that moment, when I meet her/him for the first time. (Night time safety helper/ care service cooperative, nation-wide network.)

On the contrary, the results indicated that some actors within safety telephone services have been able to create meaningful and well-functioning practices to overcome the difficulties related to security of and access to customer information. The results implied that these practices are based especially on confidential human and collaboration relations as well as pure purposefulness. The following quotations illustrate the situation. The locality here is a medium-sized city.

Our collaboration with the city has over the years been very close and firm. […] We have certain customers whom we have agreed to care for, and we obtain the sufficient personal and health information […] Transfer of information has functioned well – for instance, if a customer is hospitalised, we are very quickly informed, either by social workers at the hospital or the municipal home care supervisor, that 'this person is now at the hospital, there is no need to visit her/him at home in the evening'. Very tight collaboration, and there are faxes, telephones, ordinary mail, everything functions so well… (Private home care company, nation-wide network.)

We do not accept that [we would not obtain customer information]. […] We have many laws here that oblige us concerning privacy and other things […] So we must be allowed to include in all these contracts of purchase of services provisions on gaining access to sufficient information to be able to care for those customers. (Private home care company, nation-wide network.)

The lack of basic information on customers was also found to lead to problems in prioritisation of customer visits – in other words, management of precious time resources. For instance, a night time safety helper has difficulties in assessing how to arrange visits, if she/he is called out to help several customers at the same time, or if she/he is just on a normal visit in the home of a customer who gets regular night time care. Who needs the help most urgently?

In addition to problems related to access to basic customer information, transfer of information on, for instance, a considerable change in a customer's condition of health may be entirely a matter of chance – if such information is transferred at all. As discussed also in the context of the earlier dimensions, consistent procedures were found to be rare.

Yes, well, we do get that kind of information … but it may come in a kind of a roundabout way, sometimes. (Ambulance driver/ telephone installer, nation-wide network.)

If, for instance, a municipal home help notices during her/his regular visits that a customer is in a considerably weaker condition than earlier, this information was found to be relayed until the call centre only very rarely. The problem is even bigger in situations, where the customer is not in the sphere of any type of regular services. For many reasons, updating of customer information was found to be a very difficult question, but the results also implied that for overall quality of safety telephone services, this type of information is of essential importance.

To sum up, the analysis of the basis of customer information resulted in the following main findings:

- According to the respondents, collection, updating and supplementing of customer information often receive meagre attention.
- Awareness in the networks of the importance of good customer information and its impact on the services is often low.
- Transfer of basic customer information to all the network partners is usually unsecured.
- Expressions of consent of customers are barely utilized to smoothen information flows.
- Consistent structure in customer information forms across a network may be missing.
- There is a need for good correspondence between the operations of a network and customer information requirements related to them, but this need is often unacknowledged.

5.2.3.2 Alarm and technical information

An analysis of the sources of alarm information is *not applicable*. The source of alarm information is overwhelmingly the customer – or in rare cases, a near relative or, for instance, a home help. Part of the information that is transferred in the context of alarms does come from the database with customer information (basic information on the customer's health, special remarks and information on near relatives for communication on possible hospitalisation). These were discussed in the context of customer information.

Information on safety helpers' visits and actions is a special type of alarm information related more to after-care and follow-up than the alarm situation itself. Even there, the source of that information is not problematic. This type of information will be discussed in the context of the other stages of analysis.

An analysis of the sources of technical information is *not applicable* either. The source is the telephone appliance itself (in case of need to change the battery and disconnection or connection of appliance) or the customer – or a relative or a care professional visiting her/him (in case of service needs and alike).

5.2.3.3 Network information

The results of altogether nineteen types of analysis are presented in the present dissertation (see Table 10 on the relevance of the different types of analysis in this dissertation). From this chapter on, a synthesis of all the information quality dimensions investigated is given, for the type of information in question.

To start with, the concept of the basis of network information needs to be discussed. It is here understood from two points of view. The first is network partners – each of them is a source of network information towards the other network partners. The other is – what is here called – a network information database. On the basis of the results, such databases do not exist yet – rather, information on network partners seems to be here and there, in people's heads as tacit knowledge or otherwise stored in an inconsistent manner. The results clearly showed that in a nation-wide network, as also in the other networks, some form of a network information database would be welcome – with access for all the network partners.

Timeliness of the basis of network information was found to require consistent attention. In large networks, the number of collaboration partners within a network is typically very high. Within one locality, the number may rise to tens of organizations. In small towns and in the countryside, the number was found to be a lot smaller, for instance around five organizations. As to internal safety telephone systems of blocks of service flats, network partners are even fewer than that.

If one call centre receives calls from tens of localities, even small ones, it is easy to imagine the enormous challenges with regard to transferring, updating and supplementing information related to the collaboration network. The flows of information cannot go from the call centre to the different geographical localities only, but also vice versa – and preferably between the collaborators in each locality. The diverse challenges were clearly shown in the results – there is either insufficient or non-existent information on the organization of network operations in the first place, or insufficient or non-existent information on changes in the network.

Nobody has told me much about this change in the organization of operations [at the call centre] and other such things, so in that sense I depend fully on my own interest – what I want to know about them. Nobody tells me about them, unless I find out by myself […] That communication is not necessarily functioning then… (Local contact person/ telephone installer, nation-wide network.)

I, at least, would be interested in the company and its call centre, how it operates in practice usually, and what that point there is. It is somehow, something foggy. I would quite like to get to know it. When you work at this end only, you don't understand how it all goes in practice – all these links and such. (Employee of municipal home care service, nation-wide network.)

Timeliness of contact information of collaborators and relaying of information on changes in it were also found to be problematic. The importance of the issue in general was found to be unclear in many instances. For example, it may be difficult to grasp for municipal personnel that the call centre staff in another city does not know the areas of the city they call to – so that they would know which telephone number to call next time, if they first had a wrong number.

…Or a municipal home help says that it is not my business [when called out to help in an alarm situation] but does not tell where to call then. Hangs up. All the municipal personnel are not aware of our alarm chain, how it works. […] That they could take the alarm information and mutually transfer it to the person who can help. There are still many gaps in that… (Safety helper/ telephone installer, nation-wide network.)

The results concerning timeliness also illustrate the fact that relevancy was not an issue here, because the problem is lacking or insufficient network information – not information overload. Should network information begin to 'flood in', relevancy might become an issue.

Objectivity, believability and security are dimensions that were also investigated. They were found to call for few or no comments in the context of the sources of network information. For instance, the security dimension is not at all applicable to network information. On the contrary – if the sources of network information were closed for reasons of security, this would seriously hamper the operations of the networks.

Accuracy, completeness and accessibility are closely related to timeliness here. The above results on timeliness and quotations from interviews showed the problems related to accuracy, completeness and accessibility of the sources of network information. Accessibility of feedback from customers and collaboration partners is an important topic. In only one of the networks investigated, feedback issues are addressed in a systematic manner. In particular, feedback from collaboration partners seems to receive very meagre attention. It is not sought for and transferred – even if some feedback from customers may be elicited. The results imply that one factor behind this may be that collaboration partners are not particularly knowledgeable about being part of a network.

To sum up, the analysis of the basis of network information showed that

- There is either very little, inaccurate or non-existent information on the organization of the networks in the first place and/or little, inaccurate or non-existent information on changes.
- The mere existence of network information as a separate type was usually unacknowledged, although pieces of such information were perceived to be important.
- The security dimension is not applicable to network information.
- Feedback from customers and collaboration partners is hardly collected, transferred and stored.
- Collaboration partners in the networks are not particularly knowledgeable about being part of a network – their 'network consciousness' was often observed to be low.

5.2.4 Second stage of the operationalization: Analysis of component

The analysis of component focused on the pieces of information within safety telephone services. The quality dimensions studied were

- relevancy (the extent to which information is applicable and helpful for the task at hand),
- value added (the extent to which information is beneficial and provides advantages from its use),
- timeliness (the extent to which the age of the information is appropriate for the task at hand),
- completeness (the extent to which information is of sufficient breadth, depth and scope for the task at hand),
- appropriate amount of information (the extent to which the quantity or volume of available information is appropriate).

5.2.4.1 Customer information

The results of the analysis concerning the sources of customer information reflected the problems with completeness. They showed that some of the necessary pieces of information may be missing from customer information. This seems to be due either to inappropriate structure of the customer information form, or to missing, incomplete or inaccurate information on the form that is sent to the call centre at the time of subscribing to the service. Errors made in entering the information into the customer information database are also a possible factor, because the forms are not sent electronically but on paper – and then entered by call centre staff.

It was found out that a relevant piece of information that is not necessarily included in the customer information form is whether the customer lives alone, or with spouse or someone else. The results showed that a municipal safety telephone is usually granted only to those living alone, but there are varied practices even within the same network. In the case of private customers, this is an important piece of information, as there are no restrictions for them.

The variety of case networks and local circumstances in the present dissertation was so large that it would be misleading even in the conclusions to provide a general list of pieces of customer information that should be collected for safety telephone services. The requirements – value added and appropriate amount of information – for customer information were found to depend to such a great extent on the type of network. The requirements are particularly demanding in the case of very large networks. Another issue that came up is the concern about customers who are not in the sphere of any regular services – or any

services other than safety telephone services. Their customer information bears a special weight.

Apart from the need to look at each piece of customer information and assess its relevancy, the results of this analysis again brought up the importance of updating the necessary pieces of customer information to ensure their timeliness. The results showed that up-to-date customer information is vital for the call centre and service providers in decision-making when a customer gives an alarm call.

The results showed that, unfortunately, the extent to which customer information is updated often depends on the customers' activity and ability. Near relatives may also be active in this regard, but it was found out that quite often, none of the potential updaters are well aware of the importance of up-to-date and accurate information as well as its relation to service quality. On the basis of the results, few service providers were aware of this, either. Those who had had special problems due to missing or outdated customer information had thought of this issue – others usually had not.

5.2.4.2   Alarm information

The results showed that procedures at call centres are often inconsistent in giving alarm information to collaboration partners, the safety helpers. Customers' service chain begins at the call centre when an alarm call is received. It was found out that all the safety helpers do not necessarily get the same amount and type of information on the customer. A lot appears to depend on the call centre staff member who happens to receive the alarm call. This has to do with relevancy, completeness and appropriate amount of information.

> *[When an alarm comes], we get the customer's name, address and the number of the safety telephone. Then sometimes, we have to ask and ask what might be the problem there. … It depends on the call centre employee who gets in touch with us. Sometimes we get clear information that the customer has fallen, but sometimes they just call and say the customer's name – and then we have to 'milk' information on what might have happened. […] For us, it is always nicer to get clear information, or I mean, some indication of what has happened. When we go in the dark and to other people's homes, places we don't know, it is much nicer to know what we will face. (Night time safety helper/ care service cooperative, nation-wide network.)*

[At the call centre] they say that the customer has fallen, or if they have got into communication with the customer so that they have heard what she/he says, it is told to us […] Of course, depending on the kind of person who works at the call centre – there are different kinds of people there. But some of them give very detailed information on what has happened, and others give less detailed information. (Representative of a non-governmental organization offering safety telephone services, nation-wide network.)

The results imply that at present, many challenges in transferring the right pieces of alarm information are related to actions and reactions of call centre staff. The issue of expressions of consent is also relevant in this context. The results showed that in the future, further expressions of consent by customers may be necessary to ensure high service quality. This has to do with the quality dimension of value added.

A special type of alarm information is information on visits and actions of safety helpers. It is information that is transferred during or following the alarm situation, and it was found to be important with regard to after-care and follow-up. One way to transfer this information is that safety helpers leave a note in the customer's home with information on when they visited and what the reason for the visit was. However, it was found out that relaying such information to others as appropriate would be useful for the customer and service providers. Here, timeliness is an important dimension.

The results showed that relaying of information to relevant service providers – for instance, municipal home care service – on a customer's hospitalisation is usually a matter a chance. Only in a few localities of those investigated, bigger or smaller towns, communication takes place systematically. Safety helpers or other participants in the customer's service chain make a phone call in the morning to those concerned with day time services, if they know that the customer has some municipal services. In other localities, no communication takes place, or information may come from the hospital, depending on who happens to be on duty there. Near relatives are informed of hospitalisation, if the customer so wishes at the time of subscribing to the safety telephone service.

The results showed that information on visits and actions of safety helpers would facilitate planning of the work of municipal home helps and other care workers. It was also found out that the newest technology – for

instance, accessories of safety telephones – exacerbates the situation of insufficient information flows. Some accessories increase the need to know quickly and surely about safety helpers' visits, as shown by the following quotation concerning dosers of medicine.

If a safety helper has visited the customer, for instance, Friday evening, and the following visit by our staff is on Monday […] if our staff has dosed the medicine and checked that there is a sufficient amount until the beginning of the following week – but if the disk turns when someone extra takes out medicine and handles the doser in the wrong way, then there might be just empty holes. [...] We have to negotiate with the safety helpers that we would be informed in the morning that the customer has given an alarm, so that we would know already when we go there... (Representative of a non-governmental organization offering home care services, nation-wide network.)

It was found out that problems in communication are typically caused by different working hours of night time safety helpers and those working during day time. However, ways to overcome these problems could be found with the help of automatisation of production and relaying of information – which is not yet utilized.

There is e-mail and text message, and all kinds of systems probably [...] and timewise, it would not take a lot of their working time probably – so one would think that it is just about finding the right channel. (Representative of a non-governmental organization offering home care services, nation-wide network.)

5.2.4.3   Technical information

An investigation of the pieces of technical information is *not applicable* within safety telephone services. The information is usually relayed automatically, in a standard format. When this is not the case, technical information is such that the relevant pieces of it are bound to be available or requested by those concerned.

5.2.4.4   Network information

Relevancy and value added of the right pieces of network information were found to be high. In many ways, network information lays the foundation for the other operations. Yet, it was found to be the least

recognized and acknowledged. It seems to be taken for granted – or rather, its absence is taken for granted. Again, we are in a situation where the precise requirements depend largely on the type of network in question. Therefore, apart from what is listed in Table 8, no list of the necessary and relevant pieces of network information is provided here.

Organization of operations within the networks was found to be unclear to many interviewees. Completeness and appropriate amount of pieces of network information thus proved to need improvement.

> *[What happens when a customer gives an alarm] would be interesting to run through, that would even clarify my own thinking. Customers sometimes ask about it, and I don't dare to say for sure how it goes. […] Relatively well it has functioned anyway – the division of responsibilities has been rather clear. Although for us, it seems sometimes unclear – how does it function in the first place. We have not faced any catastrophes, however – the system has functioned anyhow. (Employee of municipal home care service, nation-wide network.)*

Timeliness of the pieces of network information was found to be a cause for concern. The results showed that safety helpers of companies and non-governmental organizations often change quickly, particularly in bigger cities and towns, where there are many people doing gigs in the field. This increases the need for continuous provision of up-to-date pieces of network information. The municipal personnel also changes, so even though the staff would just have been informed, newest employees do not necessarily know about safety telephone services.

The results showed that in accordance with local circumstances, attention should be paid to, inter alia, ensuring that staff members meeting the customer often – such as home helps – get guidance in safety telephone service related matters. An example of a 'best practice' was provision of information from time to time in home helps' staff meetings. Although such information may also include matters related to technology, it is here discussed in the context of network information due to its high relevancy for network operations. Home helps can, again, give guidance to customers. What needs to be taken into account when using a safety telephone may be forgotten. The results indicated that it has been useful to run through these things on a regular basis.

> *At the staff meeting, we went through safety telephone related matters – what needs to be taken into account and how the telephone functions, and*

how the alarms function and so forth. Very basic things tend to be forgotten, it is necessary to go through them regularly. […] We wanted to tell that the telephone doesn't bite and that it can be dusted … Because there are such views that you couldn't touch it, and then you always call … [the call centre] that there is now something wrong with the appliance… and perhaps it is simply disconnected… such very little things. So, we went to give some advice to those home helps – what you can do, and that you can change its place at home, and these things … We were at a monthly staff meeting and gave a quick one-hour lecture. (Local contact person/ telephone installer, nation-wide network.)

The customers tend to forget the whole telephone, so home helps are the ones who should be informed and reminded repeatedly, so that they would check daily or weekly when they visit customers that wristbands are worn and not nailed on the wall. There are all kinds of special 'tunings'. (Local contact person/ telephone installer, nation-wide network.)

The results showed how the lack of the necessary pieces of network information hampers the work of call centre staff and safety helpers. Problems were found to be caused by, for instance, lack of information at the call centre on safety helper resources in different localities during all hours of the day.

If we say that we know the customer is such […] that it is no use sending one home help there, that it is not enough, and an ambulance should be called out. Sometimes the reaction [from the call centre] is 'well, is it necessary', and we have to start debating here if it is necessary, and the customer needs the help anyway… They don't trust when we say that it doesn't work with only one home help. […] We would hope that they would then call out help without delays. Although it is not a question of a need for an ambulance, but because there are no male staff who have strength enough to lift, and they are not available from elsewhere, either. (Employee of municipal home care service, nation-wide network.)

The results showed that especially in small towns and in the countryside, customers are usually well known. It should be in everyone's interest to avoid internal 'yes – no' discussions within the collaboration networks. The matter has to do with building of trust within multiprofessional networks and virtual teams.

The results implied that pieces of network information might function as an important means to create goodwill within large, heterogeneous safety telephone service networks. It was found out that in big networks,

particularly localities that are geographically distant from the call centre would need to be focused on. Especially times of change in the organization of operations are significant.

> *…It feels as if we have fallen off to the periphery now – abandoned here to act, left a little bit to our fate, as long as we bring in good returns. New subscriptions have been placed, so […] The operations have changed enormously. (Local contact person/ safety helper, nation-wide network.)*

Apart from operational safety telephone service networks, the results implied that certain pieces of network information could be utilized to create an improved understanding of the situation at the municipal level. The results showed that a majority of actors within the safety telephone service networks investigated hope that large-scale municipal level collaboration would be organized. There are often several parallel safety telephone service systems in municipalities – apart from a municipal system, there may be several company-operated, local or national, systems as well as services offered by non-governmental organizations and foundations – and nobody or no organization has a picture of the whole. It was found out that one person may be involved in several networks, which easily leads to further confusion and exacerbates problems related to information flows.

5.2.5 Third stage of the operationalization: Analysis of content and instrument

This stage of analysis was based on a large number of information quality dimensions (definitions are from Wang and Strong, 1996):

- accuracy, including accurate coding of message,
- objectivity,
- believability,
- reputation (the extent to which information is trusted or highly regarded in terms of its source or content),
- interpretability (the extent to which information is in appropriate language and units and the data definitions are clear),
- ease of understanding (the extent to which information is clear without ambiguity and easily comprehended),
- concise representation (the extent to which information is compactly represented without being overwhelming, i.e., brief in presentation, yet complete and to the point),

- consistent representation (the extent to which information is always presented in the same format and is compatible with previous information),
- ease of operation (the extent to which information is easily managed and manipulated, i.e., updated, moved, aggregated, reproduced and customized),
- traceability (the extent to which information is well documented, verifiable and easily attributed to a source),
- flexibility (the extent to which information is expandable, adaptable and easily applied to other needs).

This stage of analysis was not applicable with regard to technical information.

5.2.5.1 Customer information

Accuracy, objectivity and believability are dimensions that have already been presented in previous chapters with regard to customer information. The results indicated concerning content and instrument that there are no specifications as to how the right pieces of customer information from the right sources are transferred to collaboration partners when a new customer subscribes to the service. It was found out that, quite often, that information is not transferred at all. When it is, it seems to take place on an *ad hoc* basis. Consideration of the network perspective – what collaboration partners in that particular type of network would need to know about their customers – is missing. This also has to do with ease of understanding as well as concise and consistent representation of the customer information transferred.

Reputation of customer information was not a cause for concern in these services, according to the results. In databases with customer information, information is presented in a consistent and concise manner. It was found out, however, that interpretability and ease of understanding of customer information in databases is not self-evident. The results showed that increasing attention should be paid to the structure of the form that customers (or someone on their behalf) first fill in – and accordingly, the structure of the database with customer information. Definitions for, for instance, poor hearing and other information on health condition were found to be unclear, which may lead to ambiguity. In addition, it may be difficult for a customer-to-be to comprehend why there

is a question on, for instance, other services on the form to be filled in – unless appropriate explanations are given.

Updating of customer information (ease of operation) was discussed in previous chapters. It was also found out that customisation of customer information is hardly utilized. This issue is further elaborated in the chapter on recommendations. Traceability of customer information was not found to be a cause for concern at present. In the future, if customer information is increasingly updated and supplemented, the necessity of being easily attributed to a source needs to be taken into account. Flexibility with regard to the form of customer information is relevant when we look at whether the information is easily applied to other needs (here understood as needs for transfer in alarm situations). The results implied that hardly any consideration is given to the types of customer information that are needed for transfer in the network in question in alarm situations.

5.2.5.2   Alarm information

Accurate coding of message was here included as a service-specific additional remark. The results showed that it was generally not considered problematic to interpret the information that a customer gives in an alarm call. However, the results indicated that in geographically large networks, different dialects sometimes cause problems in mutual understanding between the call centre staff and customers (cf. Pekkarinen, 2003). On the other hand, immigration of speakers of languages other than Finnish or Swedish has not had any observable impact on such matters so far.

In safety telephone services, full accuracy of alarm information cannot be assured. The moment when an alarm call is received at a call centre is quite demanding. It was found out that personality and experience of the call centre staff are crucial. In one of the big networks, there are specific qualification requirements for the call centre personnel including requirements concerning type of working experience and exact type of education. In the other networks, the situation is varied. Again, however, the type of network was found to affect the demands of the work at call centres. In small call centres – for instance, in small municipalities – the call centre staff members know the customers and typical reasons for their calls.

The dimensions of objectivity, believability and reputation call for no special comments here. Interpretability, ease of understanding, concise representation and consistent representation have to do with the issue of call centre staff giving inconsistent alarm information to safety helpers. As noted earlier, the results showed that all the safety helpers do not necessarily get the same amount and type of information on the alarm. The information may be ambiguous, incomplete and presented in varied formats.

Flexibility, traceability and ease of operation are not well applicable to alarm information. A further issue that is related to the form of alarm information is entry of so-called action codes by the call centre staff to the customer information database. Molander (2003) found out that boundaries between codes often blur. The codes are utilized to indicate the reason for the alarm call and the actions taken at the call centre. These codes were thus observed to require clarification.

5.2.5.3 Network information

The most important dimensions for the content and instrument of network information were found to be ease of operation, interpretability, ease of understanding, concise representation and consistent representation. Accuracy with regard to content is essential as well. On the other hand, objectivity, believability, reputation, traceability and flexibility are not central in the case of network information.

The results showed that the main emphasis in the networks should first be on making network partners aware of what network information is and how it affects the operations of the networks. These were found to be unclear to the majority of interviewees. In the transfer of network information, its usability (ease of operation and the other most important dimensions mentioned above) has not been focused on. Definitions for the kinds of network information that are needed in each network were found to be missing.

As to the instrument of network information, the results showed that at least in big networks, a network information database (an intranet) might be a way to solve many problems in the transfer of such information in an accurate, interpretable, understandable, concise and consistent manner. Other instruments appear to make the amount of information almost non-

manageable, even with improvements in the contents of network information.

5.2.6 Fourth stage of the operationalization: Analysis of timing

This stage of analysis focuses on three dimensions of information quality: timeliness, relevancy and appropriate velocity. Appropriate velocity is a service-specific dimension that was added to the information quality analysis framework for the purposes of the present dissertation.

5.2.6.1 Customer information

There are two points of view to timing concerning customer information: availability of updates and transfer of customer information together with alarm information. Timeliness is related to the first point and relevancy to the second point. As was shown in the results of the earlier stages of analysis, availability of updates of customer information is a cause for concern. Transfer of the relevant pieces of customer information in alarm contexts was also found to be problematic.

Appropriate velocity was observed to be related to how quickly subscriptions of new customers are handled, how quickly changes in customer information are notified, how quickly these changes are entered into the customer information database and how quickly they are communicated to collaboration partners.

The results showed that in a few cases, subscriptions of new customers have been handled too quickly at the call centre. For instance, if the customer has expressed a wish that the telephone installation would take place on a particular day when near relatives are present, this wish has not reached the telephone installer on time – but she/he has visited the customer too early. It was also found to be important that the installer has received a copy of the customer information form before the installation so that she/he has a chance to supplement the customer information, if necessary.

The results showed, however, that in most cases, subscriptions are handled at appropriate velocity – the safety telephone is normally installed within a week. Changes in customer information are not notified, entered or communicated at appropriate velocity – except very rarely. Or, if they

are notified and entered into the database quickly, communication to collaboration partners is not functioning.

5.2.6.2 Alarm information

Timeliness and relevancy call for no comments in the case of alarm information. Appropriate velocity has to do with how quickly incoming alarm calls are answered, how quickly relevant service providers are called out to provide help and how quickly help is finally provided to the customer. The results showed that although there are sometimes delays of a few minutes in answering the incoming calls, they are generally answered quickly. Relevant service providers are also called out to provide help without delays.

Delays in provision of help, however, may be significant. In big cities, non-urgent alarms may result in a waiting time of two hours. The results showed that there are often guidelines or principles for how quickly help is provided – for instance, within half an hour. However, it also appears that customers and collaboration partners are not necessarily aware of these principles.

5.2.6.3 Technical information

Timeliness and relevancy do not call for any comments in the case of technical information, either. With regard to appropriate velocity, it has an inherent value, even if timeliness would not cause any concern. The results showed that reactions to technical alarms are sometimes slow – numerous alarms on an empty battery may be relayed to the call centre before the matter is attended to. It was found out that there are no specifications as to how quickly such matters are dealt with. On the other hand, with regard to bigger problems such as technical faults due to thunderstorms, repairs were thanked for their smoothness.

5.2.6.4 Network information

As noted in the earlier results, timeliness and relevancy of network information need to be focused on. Network information is not available at the right moment, in a timely manner. Timing of network information was

found to be important – such information is relevant (applicable and helpful) for operations within safety telephone services.

Appropriate velocity can be seen in this context as related to (i) notifying of changes in network information and (ii) transfer of feedback information. Problems in the first have been addressed. Feedback information was found to receive meagre attention. In one of the networks, however, procedures for dealing with feedback from customers are clearly defined, and velocity is particularly valued. It is specified that when customer feedback is received, the customer has to be contacted again as soon as possible to explain in detail what has happened – why, for instance, it has taken longer than expected for the safety helpers to arrive. This practice was exemplary in comparison to the other networks investigated.

5.2.7 Fifth stage of the operationalization: Analysis of routing

The analysis of routing focused on the following information quality dimensions:

- accessibility,
- security,
- relevancy,
- value added,
- traceability.

Their definitions are given in earlier chapters and in Annex 2.

5.2.7.1 Customer information

Customer information was found to be inaccessible to many network partners in the nation-wide network. This is often due to reasons of security and confidentiality, but also to undefined routing procedures as well as lack of awareness concerning relevancy and value added of customer information for the partners. Traceability was not found to be a problem, because the problems are related to lack of updating and lack of transfer of customer information – not information overload and superfluous information.

5.2.7.2 Alarm information

Problems in routing of alarm information were found to be related to differences in the organization of operations by hour of the day. The five dimensions that were looked into, on the other hand, are not well applicable to alarm information.

The results showed that it is very typical that operations are organized differently during day, evening and night. In one locality, one day may be divided into, for instance, six periods of different length during which different safety helpers from different organizations are on duty. This places big challenges on routing of alarm information.

> *…We are also often asked to start off right after eight pm., but […] we have now decided that we don't go before 9.30 pm. at all. Because our contracts are only valid from 10 pm. […] We have been flexible any way… Wherever it now comes from – asks if I will start off… Or then, part of them [the call centre staff] only says that such and such an alarm has been given – and then we have to say that our working time has not yet started. It is not always clear to them […]. Only when we say that, and they start to check more carefully in the database and papers – I don't know which – but then they say 'oh yes, that's right, that's what it says here'… (Night time safety helper/ care service cooperative, nation-wide network.)*

Another factor that was found to affect routing of alarm information is that in some localities, the governmental regional emergency centre may belong in the safety telephone service network. The results showed that its role may differ from that of other partners, which may affect routing of alarm information – either in a positive or negative way, as shown by the following quotations.

> *The collaboration with the call centre and the regional emergency centre – well, that should somehow be intensified so that it would function better. Now it is slow in a way. When it is first relayed through the call centre, and they have to relay the information to the emergency centre then. Well, it takes time, and then it has been experienced that they want to make sure there at the call centre that the alarm they give to the emergency centre is definitely justified. (Employee of municipal home care service, nation-wide network.)*

> *Yes, the ambulance alarm comes through well, although it comes in a roundabout way – but it is to the point… Then also at the call centre, they understand how the regional emergency centre asks very detailed*

questions about the case – so the call centre staff members are also conscious about the need to ask those questions [from the customer]. (Ambulance driver/ telephone installer, nation-wide network.)

The results showed that the attitude at the call centre towards regional emergency centres may thus differ from the attitude towards other collaboration partners. It appears that it would be beneficial to strive at greater coherence in this matter.

5.2.7.3 Technical information

Routing of technical information was not found to be a cause for concern. None of the information quality dimensions (accessibility, security, relevancy, value added and traceability) call for any comments either.

5.2.7.4 Network information

Routing of network information concerns (i) routing between the call centre and collaboration partners and (ii) routing among collaboration partners. The results showed that routing between the call centre and collaboration partners may function somehow, but without clear procedures and definition of practices. Routing among collaboration partners functions only in a few cases, where contacts have been developed and are maintained by particularly active individuals.

Security is not applicable to routing of network information. As noted earlier, accessibility of network information was found to be poor in the safety telephone service networks investigated. Awareness concerning relevancy and value added of network information was also found to be low. There is no cause for concern related to relevancy and value added of network information in its different places at present – due to scarcity of such information. Traceability causes no concern either, but it is argued that a network information database with access for the whole network in question could contribute to avoiding problems related to traceability also in the future.

5.2.8 Sixth stage of the operationalization: Analysis of processing procedures

This stage focuses on the largest number of information quality dimensions – altogether twelve:

- accessibility (intellectual and physical),
- security,
- interpretability,
- ease of understanding,
- concise representation,
- consistent representation,
- traceability,
- cost-effectiveness (the extent to which the cost of collecting appropriate information is reasonable),
- ease of operation,
- authority of person handling,
- appropriate velocity,
- sustainability (costs and ethical aspects).

The two-dimensional view of accessibility as divided into intellectual and physical accessibility for the purposes of the present dissertation highlights the importance of handling information in a way that ensures intellectual accessibility within the typical, very heterogeneous safety telephone service networks. Intellectual accessibility is related to ease of understanding and interpretability, but it is understood to be wider and to require a comprehensive consideration of collaborators' points of view and needs.

Authority of person handling is mainly related to confidentiality of health-related information. Sustainability with regard to costs is connected to cost-effectiveness, but concerns a bigger whole – in addition to the costs of collecting information, the costs of storing and transferring information and of information systems, as well as the quality costs of missing, incomplete and incorrect information, inappropriate or inefficient services and of missing follow-up and assessment of customers' services. Sustainability with regard to ethical aspects concerns overall practices and management of information processing in a way that ensures consideration of the customer's point of view.

An investigation of technical information is not applicable at this stage of analysis.

5.2.8.1 Customer information

There are very few results left to bring up that would have been completely omitted from the previous stages of analysis. To avoid repetition at this stage, only the dimensions of accessibility (intellectual and physical), cost-effectiveness, authority of person handling and sustainability (costs and ethical aspects) are discussed in the following.

It was found out that there are problems in both intellectual and physical accessibility of customer information. Intellectual accessibility is related to, first of all, the definitions of different pieces of customer information, which were found to be unclear. This makes it difficult for customers or others filling in the customer information forms to know how to respond with regard to details concerning health condition. The unclarity follows with the forms to the call centre, where the information is entered into the database. When this customer information is then utilized in the context of alarm situations, problems in intellectual accessibility may arise – if not at the call centre, then among collaboration partners who receive pieces of that information. Safety telephone service networks – particularly the nation-wide network – consist of a large amount of professionals from many fields, in different localities and work environments.

Problems related to physical accessibility of customer information were already discussed earlier in the present dissertation. It appears that improvement of intellectual accessibility would require a detailed analysis of the networks' customer information forms to check that definitions of, in particular, information on health condition are clear. The other pieces of customer information – name, address, medication, other services, near relatives and so forth – do not appear to be intellectually inaccessible. It was observed that the forms have not been checked in this way in the networks and – importantly – with consideration of the network collaborators' views on what kind of customer information they would benefit from.

According to the results, it seems that cost-effectiveness of customer information could be improved significantly without extra costs. Better customer information could be collected after improving customer information forms and drafting guidelines for those who fill them in. Authority of person handling customer information is an important issue, but the results showed that customers' expressions of consent could be

utilized to a much greater extent to overcome problems in this regard in the heterogeneous multi-actor, multi-professional networks investigated.

The results implied that sustainability with regard to information-related costs would not likely cause concerns even after improvements in processing procedures of customer information. The results of the previous stages of analysis showed that (i) many shortcomings are exacerbated by lack of awareness concerning information-related matters and (ii) many improvements could be made by raising awareness and by clarifying procedures. Improvements are not likely to be very costly, but the results have shown that the quality costs of missing, incomplete and incorrect information, inappropriate or inefficient services and of missing follow-up and assessment of customers' services appear to be very high in safety telephone services. The results imply that this kind of thinking of information-related quality costs is not widespread within these services. A fruitful future research agenda would be to discuss these quality costs in detail.

Sustainability with regard to ethical aspects (consideration of customers' points of view) is, according to the results, an area that has not yet received much attention. It remains to be seen how safety telephone services will develop – towards increasingly tailored, perhaps multi-faceted services for individual customers, or increasingly systematic concentration on the core of safety telephone services. Sustainability of processing procedures with regard to ethical aspects thus depends on the future directions in the different networks.

5.2.8.2 Alarm information

Processing procedures of alarm information have been touched upon in the previous stages of analysis. The dimensions of cost-effectiveness and authority of person handling are not applicable to alarm information. Persons handling alarm information are authorized to do so on the basis of how the operations are organized.

Intellectual accessibility of alarm information is not self-evident to safety helpers. It was found out that the information is not necessarily handled at the call centre so that all the safety helpers would get the same amount and type of alarm information. Problems in physical accessibility of alarm information concern information on safety helpers' visits and actions in customers' homes. The results showed clearly that there are

significant bottlenecks in the flows of such information to those who would benefit from it (such as municipal authorities).

Sustainability with regard to costs is related in the case of alarm information to

- costs of information systems (that are beyond the scope of the present dissertation),
- quality costs of poor transfer of alarm information to the collaboration network that possibly leads to service defects,
- quality costs of missing follow-up and assessment of customers' services (cf. physical inaccessibility of alarm information concerning safety helpers' visits and actions in customers' homes).

The results showed that the way in which alarm information is presently handled is quite likely to lead to the above-mentioned quality costs. On the basis of the interviews, sustainability with regard to ethical aspects, again, does not appear to be problematic in the processing procedures of alarm information.

5.2.8.3 Network information

Authority of person handling is not applicable to network information, as widest possible dissemination would be desirable. Processing procedures of network information were found to be so inconsistent that both intellectual and physical accessibility are presently causes for concern – both at the call centre and among network partners.

If dissemination of network information is improved in the future in a goal-directed way, cost-effectiveness is an important dimension to consider. The cost of collecting appropriate network information has to remain reasonable. The results imply, however, that the quality costs of missing network information may be high. On the other hand, a network information database or another type of interactive forum might not be very costly (cf. sustainability with regard to costs).

Sustainability with regard to ethical aspects concerns here the processing procedures of feedback from customers. As discussed in the results of the other stages of analysis, in only one of the networks, clear procedures for handling customer feedback have been defined and are followed. Feedback is also stored and analysed afterwards as part of consistent

quality management. The results showed that this is an area that would require increasing attention in the other networks.

5.3   Summary of the results

The results of the operationalization of the framework of information quality analysis are summarized in Table 13. It shows the whole structure of the analysis that was undertaken. For each stage of analysis, the relevant types of information are listed. For each type of information, the quality dimensions that were found to be particularly central in the analysis are written in bold. Those quality dimensions that are of lesser importance are written in normal letters, and those of no importance are in brackets.

The results are not summarized by type of network here. Although the type of network was found to affect many things, it also became evident that – apart from internal safety telephone systems of individual blocks of service flats – the problems and challenges in the operations are very similar. There are differences in the scale of problems and challenges between the networks investigated. In this operationalization of the framework of information quality analysis, however, it was not meaningful to run through all the details. Significant differences have been noted in the presentation of the results of the analysis.

The summary table (Table 13) indicates that the operationalization led to useful results that can be utilized as guidelines when planning information-related matters in the networks in the future. Particularly the dimensions written in bold deserve to be focused on.

The summarized results also show that the utilization of the framework of analysis that was developed in the present dissertation – in combination with the other steps of the comprehensive information quality analysis – results in a multi-faceted picture of the state of information quality. Although there was some overlap in the information quality dimensions investigated during the different stages of analysis, the importance of the various dimensions was discerned in a meaningful way (see, for instance, the results for customer information by stage of analysis).

There were altogether 48 assigned dimensions under the six stages of analysis. Table 13 shows that there were six of those 48 that – according to the detailed analysis – were not important for any type of information

(analysis of basis: relevancy, objectivity, believability; analysis of content and instrument: reputation, traceability; analysis of routing: traceability). Table 7, the starting point, was thus reasonably correct, and the differences between the different types of information were made visible.

As to the dimensions that were excluded from the six stages of analysis, it is claimed that if something important had been omitted, it would have come up. Table 7 was both a 'hypothesis' and based on an early assessment of the data collected. The dimensions that were not meaningful were excluded at an early stage already. The results were also discussed with the practitioners in many meetings, and these discussions support the conclusions made on the basis of the analysis.

Even in the complicated network environment of the present dissertation, it was thus possible to undertake a successful operationalization of the framework of analysis. For utilization in practice for planning purposes, the summary table naturally needs to be read together with the full descriptions of the results.

Table 13. Summary results of the operationalization of the framework of information quality analysis

Stage of analysis	Type of information analysed	Information quality dimensions investigated
Basis: the right source of information	Customer	(Relevancy), **timeliness, completeness, accuracy**, (objectivity), (believability), **accessibility, security**
	Network	(Relevancy), **timeliness, completeness, accuracy**, (objectivity), (believability), **accessibility**, (security)
Component: the right piece of information	Customer	**Relevancy**, value added, **timeliness, completeness**, appropriate amount of information
	Alarm	**Relevancy**, value added, timeliness, **completeness, appropriate amount of information**
	Network	**Relevancy, value added, timeliness, completeness**, appropriate amount of information
Content and instrument /means: in the right form	Customer	**Accuracy** – (including accurate coding of message), objectivity, believability, (reputation), **interpretability, ease of understanding, concise representation, consistent representation, ease of operation**, (traceability), flexibility
	Alarm	Accuracy – including accurate coding of message, (objectivity), (believability), (reputation), **interpretability, ease of understanding, concise representation, consistent representation**, (ease of operation), (traceability), (flexibility)
	Network	**Accuracy** – (including accurate coding of message), (objectivity), (believability), (reputation), **interpretability, ease of understanding, concise representation, consistent representation, ease of operation**, (traceability), (flexibility)
Timing: at the right moment	Customer	**Timeliness, relevancy**, appropriate velocity
	Alarm	(Timeliness), (relevancy), **appropriate velocity**
	Technical	(Timeliness), (relevancy), **appropriate velocity**
	Network	**Timeliness, relevancy, appropriate velocity**

Routing: in the right place	Customer	**Accessibility, security, relevancy, value added,** (traceability)
	Alarm	(Accessibility), (security), (relevancy), (value added), (traceability)
	Technical	(Accessibility), (security), (relevancy), (value added), (traceability)
	Network	**Accessibility,** (security), (relevancy), (value added), (traceability)
Processing procedures: handled in the right way	Customer	**Accessibility – intellectual and physical, security, interpretability, ease of understanding, concise representation, consistent representation,** traceability, **cost-effectiveness, ease of operation, authority of person handling,** appropriate velocity, sustainability – costs, ethical aspects
	Alarm	Accessibility – **intellectual and physical,** security, **interpretability, ease of understanding, concise representation, consistent representation,** (traceability), (cost-effectiveness), (ease of operation), (authority of person handling), **appropriate velocity,** sustainability – **costs,** (ethical aspects)
	Network	**Accessibility – intellectual and physical,** (security), **interpretability, ease of understanding, concise representation, consistent representation,** (traceability), **cost-effectiveness, ease of operation,** (authority of person handling), **appropriate velocity,** sustainability – **costs, ethical aspects**

Notes:

The summary results concern the nation-wide network.

Bold letters: The quality dimensions that were found to be particularly central in the analysis.

Normal letters: The quality dimensions that are of lesser importance.

(Normal letters in brackets): The quality dimensions that are of no importance.

6 Network collaboration

6.1 Central themes

The results of the analysis of information quality on the basis of the newly developed framework implied that network collaboration is a prerequisite for many of the improvements that could be done to information quality. That analysis was, therefore, complemented by looking into the interview data again to find out more about the relationship between information quality and network collaboration. Through mind-mapping techniques, the following themes were discerned as central:

- personnel in safety telephone service networks,
- virtual networks and trust,
- collaboration between public, private and third sectors,
- initiation into network operations and communication,
- installation of safety telephone and guidance on its uses,
- monitoring of customer's condition,
- customers' regional equality,
- strategies of elderly care.
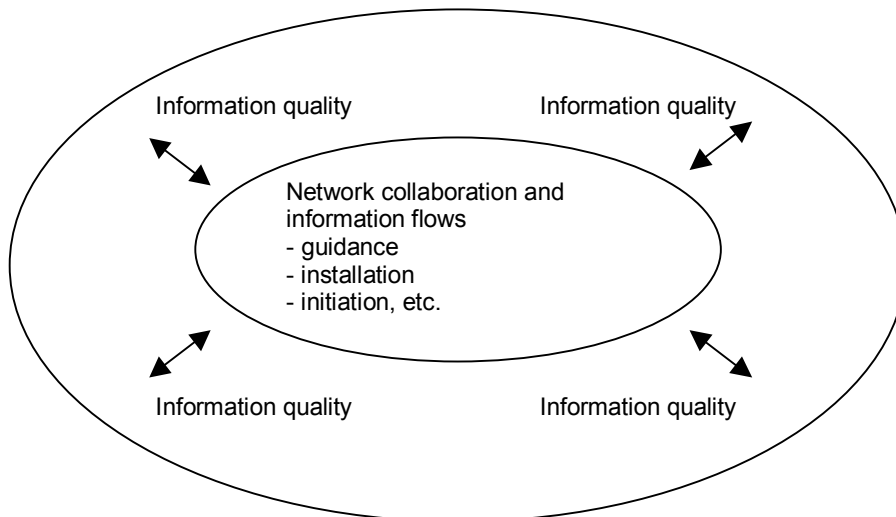
Figure 18. Information quality and network collaboration

Many of the central themes were referred to in the results of the analysis of information quality on the basis of the novel framework, but a more general view is provided here to contribute to branch-specific recommendations. The above list includes matters that were found to affect information flows and information quality (see also Figure 18), but no correlations were studied. Thus, statements about causes and effects are tentative – or avoided.

It needs to be emphasized that customers are often mentioned in this chapter, although it concerns network collaboration. This is due to the finding of the present dissertation that the customer cannot be passed as the centre. Safety telephone operations and information flows boil in so many ways down to how and when customers use the telephone, how and when they inform of changes and what kinds of customers they are.

6.2   Personnel in safety telephone service networks

Personnel issues are here discussed in relation to information flows. The topic was very often mentioned in the interviews. The interviews showed that all safety telephone service customers do not have the possibility to get help from a trained safety helper, but the helper may be a taxi driver or even a security guard.

> *Taxi drivers have the principle that they do lift [if one has fallen] but they cannot do anything about medication, because they are not medical professionals. […] They lift to bed and call an ambulance, if the customer has a fit. […] But we provide humane treatment – whatever we face in the destination, we get the work done. (Local contact person/ safety helper, nation-wide network.)*

Apart from inadequate help, the inclusion of such a wide variety of occupational groups was found to affect information flows and information quality. It is even more challenging to ensure provision of sufficient information flows in such circumstances – for reasons of privacy protection. In addition, participation of taxi drivers and alike in the present systems underscores responsibility of other, trained actors in safety telephone services of follow-up of customers' general condition and health condition. The latter factors, again, affect information flows and quality, according to the interviews.

On the other hand, the interviews indicated that the helper's personality is of utmost importance. Taxi drivers in small towns and in the countryside may be very dedicated to their task in safety telephone services, also because they often know the customers. Without taxi drivers, organization of today's safety telephone services would be problematic indeed, as there are no care professionals available 24 hours a day in these environments.

The interviews showed that – in line with increasing demand for safety telephone services – requirements for qualifications of service personnel should be discussed. The big differences in local circumstances as well as needs and views of customers obviously have to be taken into account in such discussions. Support for independent life at home seems, according to the interviews, to lead to a situation, where the reasons for alarm calls may be more and more demanding for the personnel – both those at the call centre and those in the field.

> *Now even older and sicker aged people are cared for at home, and the amount of alarm calls has, in my opinion, increased. Quite a lot, in fact. On the other hand, it depends on these new kinds of safety telephone accessories – they cause more work. (Local contact person/ safety helper, nation-wide network.)*

On the other hand, the reasons for alarm calls and needs for help can be quite intimate, which underscores the importance of the following attitude among the personnel of safety telephone services:

> *Of course, our work consists largely of normal interpersonal relationships, social relations with the elderly persons. Actually, 70% of our work here – I have said – is good behaviour, dressing and – whatever it is: clothes, equipment, instruments – it is already a big help for an elderly person that she/he is considered in that way, and then the remaining 30% is that acute work that we do, and all these sectors have to be invested in. Also in behaviour and social skills. (Ambulance driver, nation-wide network.)*

The personnel have to be well aware of their role as safety helpers. The interviews indicated that during their visit due to an alarm, the helpers have to be able to assess the need for help – whether it is really a question of a 'pure' safety telephone alarm or would the customer need, for instance, home care services or other services in the future. This professional point of view is very important with regard to follow-up of

customers' health condition and integration of safety telephone services into the whole entity of a customer's services.

6.3   Virtual networks and trust

The interview data clearly indicated that the large variety of occupational groups results in additional challenges of network management, which, again, leads to shortcomings in information flows and quality. That is particularly clear in large virtual networks, which were found to be based on relatively loose collaboration arrangements. Among the networks investigated, there were many kinds of virtual networks. At one end of the spectrum, there is the nation-wide network, in which there are many factors limiting the possibilities for regular face-to-face meetings: place, organizational and sectoral boundaries as well as even time (due to different working hours). At the other end of the spectrum, there are the in-house 'networks' of blocks of service flats, in which hardly any limiting factors exist.

Regular face-to-face meetings have been regarded in earlier studies as essential for building trust in networks (e.g., Jarvenpaa, Knoll and Leidner, 1998). Even if the limiting factors of different place and organizational boundaries can be partly overcome by using communication technologies, it may be troublesome to arrange meetings. In most of the safety telephone service networks investigated, communication technologies are not yet used to a large extent, and the 'on call' type of operations combined with the limiting factors mentioned above exacerbates the situation with regard to possibilities of meetings.

The interviews showed that the combination of hindering factors has led in the bigger networks to a situation, where collaboration partners, particularly individual employees are distant or completely unknown to each other. Organizations and individual employees in them do not sense that they belong to a network. This was found to affect information flows related to the collaboration network, its organization of operations and changes in this organization. As noted in the results of the information quality analysis, the state of network information contributes to the foundation for transfer of customer and alarm information.

Building trust starts from how collaboration is defined, initiated and structured. Participants in safety telephone service networks interact through partially independent tasks, but they should be guided by a

common purpose – especially as the networks are not formed for some project purpose but for continuous service provision. On the basis of the interviews, it seems that both the rational (fluency in communication between team members) and social (a moral obligation between team members to do what is agreed upon) perspective to trust (Jarvenpaa, Knoll and Leidner, 1998) should be focused on in safety telephone service networks in order to ease information flows.

The interviews further indicated that in virtual networks, ambiguity among collaboration partners easily arises because of unclear responsibilities and duties related to network management.

> *It is not necessarily my business, or home care supervisors' or ambulance drivers' business to say 'hey, could we get together for a meeting or something' – as we all work for [the call centre company], and shouldn't it naturally come from there, some sort of an initiative, at least? It is their task, but … (Local contact person/ telephone installer, nation-wide network.)*

> *It would be good to hold once a year, or as the need arises, some kind of a common consultation meeting. That these basic personnel would join in… […] We could exchange views and experiences. I think that mainly [the call centre company] would have many hopes and ideas for development to us here in home care services – so that it would be easy for them to do their work. [...] Even the whole municipal home care personnel and this company – it is no use arranging for small teams only [...] But probably [we have] those same experiences, and they would then be of use to everyone. (Employee of a block of service flats connected to the nation-wide network.)*

6.4 Collaboration between public, private and third sectors

Collaboration between the public and private sectors is still taking shape within the social and health care sector in Finland – including safety telephone services. Some of the effects of this situation were described in the results of the analysis of information quality, but there are also other, more indirect effects. The interviews showed very clearly the unclarity in methods of implementation of collaboration. Minor prejudice towards collaboration was sometimes discerned in both sectors.

Differences in organizational cultures between companies and municipal home care hamper collaboration, and prerequisites for collaboration are

clearly varied. The interviews showed that challenges related to financing of the public social and health care sector in the ageing society affect the work of professionals also within safety telephone services. It seems that in many cases, their time and energy would not suffice for development efforts, although they are aware of problems and are interested in solving them. Development efforts may seem time-consuming and causes of additional pressure.

The third sector – non-governmental organizations, cooperatives and foundations – contributes to the variety of actors. On the basis of the interviews, it seems that their actions within safety telephone services remind those of the private sector more than those of the public sector. The minor cleavage that was observed thus lies between the public sector, on the one hand, and the other two sectors, on the other hand.

An area affected by the unclarity in methods of collaboration is negotiations on contracts of purchase of services. Content and comprehensiveness of contract provisions were found to affect information flows and quality to a large extent. Some municipal authorities acknowledged this in the interviews, while others recognized the difficulty of negotiations, but did not seem to be well aware of the connection between contracts and information.

> *… When we had these contract negotiations – the municipality has a great deal to learn there, so that we can… In safety telephone services, it was good that we knew – it was the kind of service or field, of which we knew exactly what we need, what we want, what we are purchasing. Such bargaining and concluding of contracts … the municipality does not really have know-how in these matters. […] That is future – having the private sector as a partner in this service production […] there are lots of things that one cannot even think about beforehand. (Employee of municipal home care services, nation-wide network.)*

> *And then I have to control that and a statutory duty to oversee how the service functions. […] Well, it goes in such clear unities as safety telephone services are, when we know what we purchase. But when someone starts selling service only, service given by an individual, then we go to a completely different level … what is included in the service … there it becomes already a bit more difficult. (Employee of municipal home care services, nation-wide network.)*

The quotations above reflect a thinking of safety telephone services as a clear unity. It does not necessarily correspond to practice, as shown by

the present dissertation. Moreover, the same interviewees, who saw a clear service unity when contracts were discussed, emphasized the complexity of the services earlier or later during the interview. Attention is perhaps not given to integrating the 'system knowledge' of municipal personnel into contract negotiations.

The interviews reflected the complicated sub-contracting arrangements within safety telephone services. Some very small company may provide services, for instance, in the form of night time help. Under municipal home care, there may be different pilot projects that are managed by non-governmental organizations and aimed at special groups such as those suffering from dementia. The perspective of quality control is challenging in the multi-actor safety telephone service networks – whether it is a question of services offered to the customer by the municipality or services subscribed privately by the customer. Some municipal interviewees were quite content:

…We have nothing negative to say about [collaboration with private companies]. Everything has worked well. Of course, here in our municipality, customers and helpers – inhabitants know each other… That is really good, too. (Employee of municipal home care services, nation-wide network.)

The interviews showed the variety in how reporting, continuous communication and orientation – factors of crucial importance for information flows and quality – are included in contracts of purchase between municipalities and companies. At present, a few municipalities of those investigated had included a duty to report on safety helpers' visits: the number of visits, the customers concerned, times and reasons. Others have not included such a provision, but in the interviews, representatives of those municipalities often expressed the need for up-to-date information on these matters. For some municipalities, despite the lack of relevant provisions, the service provider (for instance, the local contact person of the call centre company) reports regularly on safety helpers' visits.

Every month, with the invoice, I send details of every alarm that we have handled, to the city. I draw up a table with date, customer's number and name, time of alarm, reason for alarm, actions taken and name of safety helper. So, they see each visit that we do, every month's report. […] They have required that kind of reporting since the beginning. Especially for their customers, but […] also for our private customers – they want to

know how many private visits we carry out. Because the city has to direct some of the requests for services [to the sphere of our services]. (Employee of private care service company, nation-wide network.)

It was found out that provisions on orientation and continuous communication are missing from contracts of purchase. Practices are quite varied. Invitations of tenders drawn up by municipalities are not focused on such matters. The needs of municipalities are not necessarily reflected in invitations of tenders – if they know what they need. Companies and other service providers, again, would include in their tender a minimum of such provisions, unless more is requested.

Where there is definitely room for improvements […] for instance, these lists of customers, who have safety telephones. I mean these updated lists – we don't get them unless we ask for them. So, sometimes we are using really old ones. We have tried at least once a year – when I have had time, I have called … 'can you send us an updated list of customers, by name and code number'. […] And then I know that they can take out statistics on reasons why an ambulance has been called out to help. […] And if we asked, we would probably get them. (Employee of municipal home care service, nation-wide network.)

6.5 Initiation into network operations and communication

The interviews showed that – although initiation into network operations and ways of work is indispensable at the beginning of collaboration – initiation was not focused on to ensure that collaboration partners 'get the picture' and can position themselves as part of the whole. Quite often, initiation is not directed to all the necessary people in a locality, till the end of the alarm chain. It may be too technically oriented towards safety telephone appliances and their use. The requirements of different kinds of actors within safety telephone services are not met. The initiation is also one-sided (for instance, from a call centre company to municipal authorities) instead of a mutual approach, which would be necessary.

There was one exception among the networks investigated – a big municipal network, where special attention is paid to integrating the private service providers into the network. They are oriented into the work of the network, and the requirements of the call centre are clarified to them. On the other hand, their views and requirements are listened.

According to the interviews, all too often ease of collaboration depends primarily on an individual person or individual persons. At the beginning of operations, as lines of action are taking shape, this is probably not to be avoided completely.

It is an advantage of a smaller town that customers are known and in the sphere of many kinds of services, and collaboration partners are known, and [...] but that is also one such asset of my work that I have seen a great deal and done so many things for so long, and I know lots of people and have created the collaboration relations already. If there were someone in my position, who had been recruited as completely new, perhaps from some other place [...] she/he couldn't have created the collaboration network so quickly... It is the company's advantage that there is someone who knows the place. [...] Learning about the collaboration partner, knowing its style, or things related to its ways to handle different matters [...] it takes time to learn... (Employee of private care service company, nation-wide network.)

[Our partner] called when she drove by, and if there was time, stopped, and we had a word and she told where they stand, what is the present state of affairs [...] with whom contracts have recently been concluded – and we always listened with great interest to how [...] they have handled these matters in different places [...] It was, indeed, handled purely through these personal relations. (Representative of a non-governmental organization providing safety telephone services, nation-wide network.)

In many of the localities and networks investigated, however, it seemed that little attention had been given to ensuring continuity of smooth collaboration and sustainable development of the services. In particular, during and after major changes in the operations of the nation-wide network, communication and new initiation had been lacking.

At the beginning, when these operations with the call centre company started ... we had meetings and discussed development work and these things to get the operations going, but [...] there has been at least half a year of such time that there is no other contact. We haven't sat down and discussed things [...] so perhaps such cooperation that regularly – as they are service providers to us – so it would indeed be good to sit down together, say every two months or so – and check where we are... (Telephone company employee/ safety telephone operations, nation-wide network.)

Yes, we can probably improve the collaboration, as long as we just do it. But I mean real collaboration so that we also meet face-to-face and not only through visits by safety helpers. We should support each other […]. There are still unsolved questions in our mutual collaboration. On the other hand, I believe that – as the city is purchasing our services – the city is such a big organization that […] in a way, their [of the city and the call centre company] reciprocal collaboration guarantees also our reciprocal collaboration. (Representative of a non-governmental organization providing home care services, nation-wide network.)

The interviews indicated that safety telephone service networks learn a lot internally and spontaneously, if opportunities are provided. There are spontaneous links in the nation-wide network, and experiences are exchanged through 'study visits'. There can be major differences between localities within one big network; what is quite advanced in one locality, may still be in its infancy in another – and vice versa. It was found out that those engaged in this spontaneous mutual learning valued it greatly and intend to keep it up. It was, however, also discerned that they valued it as a complementary activity and were hoping for increased systematic communication.

Many others who had not had the possibility to engage in such learning, expressed their willingness to participate:

Now I have developed my own lines and models of action and […] gradually learned that it doesn't work this or that way. But I don't have the slightest idea of how someone else acts. There would probably be great ideas as to how to take care of things. So, it would be nice if we had, for example, some form with a list of all the places where there are safety telephones, including contact persons, so that one could give them a ring sometime, or something… (Local contact person/ telephone installer, nation-wide network.)

On the basis of the interviews and the results of the information quality analysis, it is argued that initiation and continuous communication would facilitate overcoming of bottlenecks in information flows, such as relaying of information on hospitalisation of a customer and on visits of safety helpers. On the other hand, the investigation of network collaboration showed the difficulty of coordinating the variety of actors in safety telephone services in big cities. These services are in uncounted ways intertwined with municipal social and health care services, and the number of persons who ought to be initiated and kept informed becomes overwhelming. However, the results indicated that in small and medium-

sized towns and in the countryside, progress could be made through awareness raising and definition of systematic procedures, rights and responsibilities.

6.6 Installation of safety telephone and guidance on its uses

Initiation and continuous provision of information also concern customers. Local conditions affect – besides provision of help – installation of safety telephones. It was found out that there are quite varied practices related to who installs the telephone to the customer's home and how guidance is given on the use of the telephone: how and when to use it, and how to notify changes.

Moment of installation

The interviews as well as the results of the information quality analysis showed clearly that the moment of installation is of crucial importance for the 'success' of safety telephone services. It is not crucial simply from the customer's point of view, but also from the point of view of the service system and the network – and its information flows. The rest of this chapter provides justifications for this argument.

It was found out that in most of the networks investigated, no clear procedures are defined for how guidance should be given to the customer during installation of the telephone. Within one network, different installers have quite different approaches – one aims at emphasizing simplicity and reducing possible anxiety about the use of the telephone by giving little information in a very focused way.

In the training sessions, it has been emphasized that the installer has to tell that 'when you push this button, someone answers the alarm call, and after that, you get help'. This is the idea – it is not emphasized where the call is answered, or how it all functions there in the background, but specifically this one thing – when you feel that you need help, if perhaps someone rattles behind the window, or something like this, that there are now burglars behind the window – so you push this button, and then you get into contact with a person with whom you can talk about it. It is an important point – as naturally also the information that helpers will show up. […] At the time of installation, there are often the customer's near

relatives present, too, so this alarm chain can be explained to them as well. (Employee of telephone company/ safety telephone services, nation-wide network.)

Another installer explains:

Yes, I do go through everything, I try to leave as few gaps as possible […] so then I can complete the alarm chain – how the helper comes when the customer pushes the button – I always go through that – and then, it is told who our helpers are, and what kind of professional personnel we have. Then we have these instructions for use that I always go through [...] we give those in writing [...] (Telephone installer/ safety helper, nation-wide network.)

Still another installer emphasized strongly that installers should encounter the anxiety that customers often have; they are nervous about the appliance and the wristband. Anxiety can also be related to fears of control and loss of privacy.

There is quite a lot of suspicion – is the alarm audible and from how far. […] When there are detached houses with gardens and rear buildings […] Questions are also asked of security chains; 'what do I do now as I have a security chain on the door and I am used to keeping it closed, how does the ambulance driver get in?' – and 'how do the alarms function, if I push, and if I cannot hear anything?' And, 'what if I make a false alarm?' So, we take time at the installation for explaining these things. And we may have to explain several times that 'it doesn't matter at all, if the call goes to the call centre'. (Local contact person/ telephone installer, nation-wide network.)

It was found out that not all installers within one network give written instructions, and when they do, the instructions do not give details of which changes should be notified (for instance, changes in health condition, medication or contact information of near relatives). Moreover, the interviewees strongly emphasized the need for continuous initiation and communication towards the customers.

Guidance on uses

It was found out that service providers have different principles concerning acute emergencies. Can the customer use the safety telephone in case of emergency, or should she/he then call the general

emergency number 112? The interviews showed that the instructions concerning this important matter are not clear within all the networks investigated. Different instructions are given to customers and near relatives in different localities. The principles of the call centre are also often unclear to the network partners – and they are the ones who give the instructions to customers.

The governmental regional emergency centre is often included in the collaboration network. For instance, in some municipal systems, alarm calls outside of office hours are answered at the emergency centre. It appears that this may, according to the interviews, underscore unclarity in people's minds. For customers and network partners alike, it is essential to know – with the lowest possible ambiguity – where to call and when. It is in the interest of all parties concerned that customers' feeling of safety and security is based on realism. The interviews showed that when coherent instructions and guidance on uses of safety telephones are missing, it easily results in the creation of separate, experience-based practices that vary between individual persons.

> *If, for instance, a home help uses the safety telephone to call [from the customer's home on her/his behalf], it has proved to be a better alternative to call 112 directly instead of giving the safety telephone alarm. It is faster. When there is a care professional present, who can do that – earlier, we used to give the alarm from the safety telephones … the ambulance alarm. But now we have realized that it is the fastest way to call 112 directly. (Employee of municipal home care service, nation-wide network.)*

> *We do, of course, cooperate with the regional emergency centre in that the emergency centre knows our number and may sometimes ask us to open the door, if they know that the customer has a safety telephone. Some customers call the emergency centre – they do not understand to push the button, when there is an emergency, but they call the emergency centre directly… then the emergency centre calls us to come and open the door. (Employee of private home care service company, nation-wide network.)*

The interviews also showed that in some localities, instructions given to customers may lead to the impression that a safety telephone alarm is a recommendable alternative to contacting the police in case of, for instance, burglary. It was found out that this thinking is not in line with the principles of the call centre in question, but if it were, then it appears that the same instructions should be given to all in the same network. Positive sides to this procedure would be immediate access to customer

information in the call centre's database and provision of increasingly holistic services to the customers. Questions that are related to the future development of the service branch are returned to in the discussion and recommendations of the present dissertation.

The interviews thus indicated that clarity of instructions and guidance should be improved by locality and by network, especially in large networks. The uses of safety telephones seem to be unclear not only within safety telephone services, but also to the general public (cf., e.g., Helsingin Sanomat, 2003).

6.7 Monitoring of customer's condition

The investigation of network collaboration showed that there are often problems in taking into account prerequisites for the use of safety telephone by a customer-to-be. Without a view of the whole, a telephone is easily given to a person to whom it does not suit originally or as a result of a change in health condition. Awareness of the responsibility to try to avoid these situations among entire collaboration networks as well as among near relatives of customers requires to be raised. The issue is closely related to the need for timely and complete customer information.

That is, in my view, the biggest problem […] when safety telephones are acquired for someone – the person's mental agility. In some cases, it has been questionable. So, the person may be quite demented, in which case when the safety telephone has been installed and instructions have been given several times for how it works – then the next day, she/he has asked the home help about what it is. 'What is that appliance […] when did it show up?' […] These people would need a safety telephone, but […] the issue should be considered and talked over very carefully before taking a telephone to their home. They often make false alarms, because they are perhaps wondering what the wristband is for. No matter how many times you explain that. […] But it doesn't depend on these municipal home care supervisors only, because near relatives want these telephones for their father or mother, for their safety – but they don't internalise and understand that she/he is not fit to be a user. Despite all simplicity. […] It gives a false belief of safety for the near relatives. (Ambulance driver/ telephone installer, nation-wide network.)

For private companies, the responsibility is particularly demanding, as they also strive at getting new customers. It was found out that monitoring

of customers' situation after the installation of the safety telephone can take place at the local level in, for instance, the following way:

Then the cooperation that we have with the municipality – if, for instance, one customer has been visited by the safety helpers several times during one day, or if there are often visits for some particular reason – then we start to forward the matter. Is this customer such that she/he can still continue living at home? Or then we map the other services that she/he has and get in touch with them. (Employee of private home care service company, nation-wide network.)

Monitoring in multi-actor networks requires trust among the partners. The interviews reflected quite varying degrees of trust in different localities.

… One inhabitant in a block of service flats is such that during the day, the staff takes the wristband away, so that the customer cannot give an alarm, because she/he gives it every five minutes and burdens the staff a lot. But we don't allow that during our working hours at all. […] In my opinion, it tells a lot about how a person is doing, if there is a need for continuous alarms at night. […] So, for such matters we have had meetings now. We cannot take that responsibility […] she/he has, indeed, trusted on her/his own wristband for needs of help, but it has been taken away. Who is responsible then? […] So, we are experts during our working hours, and those working during the day are experts in daytime matters. […] Our assessments are, after all, trusted and appreciated. (Employee of private home care service company, nation-wide network.)

If the customer is at night clearly in a much worse condition than what we have seen during our earlier visits, we rather readily call an ambulance and take her/him to the hospital […]. A doctor checks up on her/him then. […] The health condition may have deteriorated clearly for months – then at night that process is much easier to get started, at least for the time being, than during the day. (Night time safety helper/ care service cooperative, nation-wide network.)

6.8   Customers' regional equality

The wide variety of local structures in safety telephone services has resulted in lack of regional equality among customers. Differences were found in, inter alia, how much time elapses from the alarm call till the safety helpers show up, what kind of a helper comes to the customer's

home, costs of services – and possibilities to obtain the service in the first place.

Of the many kinds of divisions between customers, those between rural and urban inhabitants as well as between private and municipal customers are examples. The interviews showed that there are many subdivisions affecting the service that the customers receive. In small towns and in the countryside, customers are well known, and the help is likely to reach them faster than in big cities, although the distances would be long in kilometres. The helper who arrives is, however, often not a care professional.

As to municipal customers, there are differences in their possibilities to become municipal customers. In some municipalities, there is a limit to income for persons wishing to obtain a safety telephone as part of public service provision. In other municipalities, criteria are based on health condition. The municipalities also have highly varied preconditions in terms of the number of safety telephone customers they can have – depending also on whether they purchase the services or produce them independently.

> *We considered it better to purchase the safety telephone services, because there is the advantage for us that the service provider doesn't set a limit to the number of appliances – so, at least for the time being, there haven't been situations in which we would have had to say that we cannot supply the customers with safety telephones. When we only had that certain number of appliances in use and bought additional ones within the limits of our budget, we had to have a waiting list. So, you could not necessarily obtain the appliance straight away when you needed it. Now – as the number is not defined in that way – the customer obtains it – I can say, within a week. Which is really good. (Employee of municipal home care service, nation-wide network.)*

It was found out in the present dissertation that the type of customers – private or public – often affects transfer of information between service providers as well as the extent to which safety telephone services are integrated into the whole entity of a customer's services.

Regional inequality is caused also by technical possibilities to install a safety telephone to customers' homes. In some border districts of Finland, wired telephone connections have been changed to wireless connections, which do not enable use of traditional safety telephones. It appears, on

the basis of the interviews, that improvement of regional equality among customers requires increasing attention – as the need for safety telephone services is expected to increase. Mobile safety telephones are already being tested, and in the future, customers will be able to give an alarm from outside of their homes.

The use of mobile phones already affects the use of traditional safety telephones. Usability of today's mobile phones is, however, such that they cannot entirely substitute traditional safety telephones. The possibilities do depend on the user, though.

> *…Many people have got themselves these mobile phones now. 'When I always have this mobile phone with me, I don't need that safety telephone anymore'. But for the elderly persons it is so that the keys tend to be so small – that is it 100% certain that they can get the connection? The customers themselves think it over then. Now … I just tried to persuade one person into keeping the safety telephone. Because they fall down in these fits for various reasons, even epileptic fits – but no […] she/he bought a mobile phone and said that the safety telephone is no longer needed. I did write on the form for closure that municipal authorities disagree on this, and the customer wants to give up the service – should something happen then. (Employee of municipal home care service, nation-wide network.)*

Attitudes towards and practices concerning 'chaining' of the alarm calls so that they first go to a near relative (chosen by the customer at the time of subscription) – and only if she/he does not answer, the call is relayed to the call centre – were found to be quite varied. This is also related to regional equality. It was found out that within one big network, chaining may be a possibility for customers in some localities – and not possible in other localities. There was no consistent policy from the call centre company's side, and the reasons for existence or lack of alternatives was not clear even to the network's telephone installers.

It was found out that there are two important points of view concerning chaining against each other:

1. Functioning of chaining needs to be ensured very carefully – along with chaining, answering the alarm call may be delayed, and technical factors may cause the service to become less reliable (if, for instance, the alarm is first relayed to the near relative's mobile phone).

2. The personal safety net of the customer is supported and maintained.

An intermediate form is that the alarm call is first relayed to the call centre, but from there, to a near relative – before an external service provider. In the nation-wide network, this is used in the case of individual private customers in localities where there are no other customers.

The investigation implied that an unambiguous and universally applicable solution does not exist, but the different alternatives and their characteristics should be known by customers, near relatives and service providers within networks.

Yes, I think that – if the customer wants that, and the kind of safety net exists – it is a great thing, and it should be supported as well. (Employee of municipal home care service, nation-wide network.)

But perhaps the most reliable system is that it is the call centre [that answers]. So that the alarm call is not left 'hanging' somewhere, or due to a technical fault or something like that – it is just not answered. (Employee of municipal home care service, nation-wide network.)

6.9   Strategies of elderly care

The interviews showed that safety telephone services are regarded perhaps too literally as support services in the whole of elderly care. It seems that the concept – in municipal practice – of support services leads easily to a situation, where the importance of these services as an enabler of independent life at home is not properly acknowledged. The wide-ranging cooperation and complex service structure that these services typically require also appear to be overlooked.

The interviews showed that safety telephone services are hardly taken into account in today's municipal level strategies for elderly care. The strategies emphasize, for instance, matters related to construction – alternatives for construction (like institutional living) and their costs. Safety telephones may be mentioned, but the effectiveness and development of the related service system are not considered. The interviews implied that by including safety telephone services in municipal and national level strategies, improvements in cooperation arrangements of the service

networks, information transfer and quality as well as regional equality could be facilitated.

> *Yes, the need for safety telephone services will increase, and that is where we need that cooperation – reconciliation of different fields. So, it is not merely a subordinate clause, which is just included in the strategy – it is, more often than not, a main clause… (Employee of private home care service company, nation-wide network.)*

The interviews showed that those working in safety telephone services in small and medium-sized municipalities hope for broad cooperation at municipal or even regional level. There are often several parallel safety telephone service systems in municipalities – in addition to a municipal system, there may be company-operated, either local, regional or national systems, as well as services offered by non-governmental organizations or foundations. It was found out that in such cases, nobody has a picture of the whole.

> *Some kind of cooperation or a development seminar or something like that – say, twice a year – would be appropriate, where we would think about development of the whole municipality's safety telephone service system. It could be convened by the municipality, and all the different parties would be there that have something to do with safety telephone services here. So, there would be representatives of foundations […], representatives of the congregation, the telephone company, and, of course, the municipal authorities and representatives of the call centre company. […] We would go through a few items […] and from there, it could gradually 'bounce off'. Of course, also safety helpers are important […] representatives from the municipal home care should be there. … There would be wide representation, and we could really talk about the development work. (Employee of telephone company/ safety telephone services, nation-wide network.)*

It was found out that there is a great need among potential customers – and among municipalities – to find out about different safety telephone systems. Handling matters related to safety telephone services in mutual meetings and strategies might improve individual customers' possibilities to obtain information on safety telephones and safety telephone systems. It appears that they are felt to be very difficult to compare, which may lead – at the municipal level – to difficulties in grasping the essentials of the municipality's own safety telephone service system.

[Safety telephone is] of great help and protection. But the communication – it would be good to provide a leaflet to elderly people on the existence of such a system. […] In practice, when they come, for instance, to the sphere of home care services, then at that stage, home helps could first 'sniff the air' to see if a safety telephone might be needed, and then they could hint to people about such a possibility. Then, in my opinion, the costs should also be clearly brought up. […] As the social security is so good in Finland, we are used to the health care services […] being relatively free of cost. (Ambulance driver/ telephone installer, nation-wide network.)

The interviews indicated that good channels of communication are pensioners' organizations, congregations and various activity centres for elderly people. Communication should address the concerns that safety telephones typically cause in anticipation in ageing people's minds.

6.10   Roles of network actors in relation to information

The interview data from the nation-wide network were investigated also to obtain a general view of roles within the network in relation to information. The roles that were sought for were (i) information producers, (ii) information custodians and (iii) information consumers (Strong, Lee and Wang, 1997b). The indicative mapping was done to gain additional understanding about the functioning of the network and to give directions for future research.

The following questions supported the mapping: which activities are undertaken by the different roles, which services do the roles need from their environment, which activities or steps do the actions of the role consist of and what kinds of messages and communications do the roles undertake with each other. Numbers or percentages are not presented, because the data do not support such definite categorizations. The mapping was of general nature also because roles in relation to the four different types of information (customer, alarm, technical and network information) were not investigated systematically.

The general finding was that in most cases, the interviewees did not seem to be aware of the importance of acting as information producers in addition to other tasks. For instance, a home help who provides the help to the customer may feel that she/he requires more and better information on the customer from the call centre, when an alarm call has come in.

However, she/he rarely forwards information on the customer's deteriorated health condition, such as breaking out of dementia, to relevant actors within safety telephone services – even if this change would have a serious impact on the customer's ability to use the safety telephone.

The reasons for this lack of awareness seem to be undefined rights and responsibilities with regard to information as well as unclarity about one's role in the whole of safety telephone services. The results showed clearly that every safety telephone service employee would need to be aware of the essentials of the whole infrastructure behind the services.

Many of the interviewees can be classified mainly as information consumers only. Others are 'a combination' of information producers and information consumers, or of all the three types. Information custodians were fewer than information consumers and producers, which is natural in a network that consists of many types of public, private and third sector actors and operates on the basis of confidential health-related information.

For instance, ambulance drivers are primarily information consumers only. The call centre staff, and in most cases, municipal home care service supervisors are examples of a combination of all the three types. Night time safety helpers may be, depending on the local service structure, either information consumers only, or a combination of all the three types. Municipal home helps were regarded as information consumers, sometimes in combination with the role of information custodians. Staff at blocks of service flats connected to the nation-wide network was classified as information consumers and custodians mainly. Telephone installers may be (i) information consumers only, (ii) information consumers and custodians or (iii) a combination of all the three types. These examples show the variety of roles and their combinations even within one professional group.

The results imply that a more detailed mapping that takes into account the different types of information and is done among smaller groups of people (as compared to the present dissertation) may be usefully combined with the analysis of information quality. Through assessing information needs of individual employees and organizations with this combination, additional concrete materials for development efforts concerning network management and management of information quality may be produced. This appears to be a fruitful future research agenda.

7 Discussion

7.1 Key findings

7.1.1 The framework of information quality analysis

The emphasis in this discussion is on the framework of information quality analysis, its usability and the results in light of the theoretical background of the present dissertation. This dissertation opens up new insights into three directions: (i) analysis and management of information quality, (ii) service networks based on virtualization and (iii) the branch of safety telephone services. The combination is unusual, which is one sign of novelty.

The objective of the present dissertation was to develop a framework of information quality analysis. Literature studies had shown that new tools to analyse information quality are needed, and that such analyses have not been undertaken in network environments and on the basis of qualitative interview data. The framework that was developed in the present dissertation is anchored in previous research studies, but its approach is new. It is, on the one hand, general in that it is argued to be well applicable in different organizational environments, and on the other hand, it was adapted here to the branch in which it was operationalized. The framework is thus flexible, and its future potential in organizational research seems good.

The environment of safety telephone services and their virtual networks was felt to be particularly challenging, as there were many completely different types of information transferred in multi-actor, multi-professional, multi-organizational, even multi-locality networks. Moreover, information flows form the basis for the operations in an especially clear way. In business organizations, where information quality has traditionally been studied, information is also nowadays recognized as a central production factor. However, in many companies, some form of activity might be possible without networking and smooth information flows, whereas in the networks investigated in the present dissertation, nothing would happen without information flows. The importance of information-related matters is claimed to be beyond comparison with many other fields.

Operationalization of the framework of information quality analysis in this particular environment was thus demanding. It is argued that the operationalization succeeded quite well. The analysis could be completed on the basis of interview data, and meaningful results were obtained. Suggestions concerning future use of the framework could also be formulated and are included in this dissertation. These matters should show that

- firstly, operationalization in other fields is possible and
- secondly, the framework is significant and contributes to development of qualitative tools for information quality analysis.

Having a combined framework with both the six stages of analysis and the information quality dimensions enabled a well-structured investigation of the complex information flows in the case networks. Undertaking the analysis implied that if the information quality dimensions had been used without the six stages, some issues might have remained unnoticed in the information processes.

The field of operationalization is important also because different kinds of distance care and distance service arrangements are being developed and tested – for ageing people as well as others. The analysis in the present dissertation brought up many insights that are potentially useful for such new types of social and health care services (for instance, telemedicine).

7.1.2 Usability of the framework of information quality analysis

Throughout the analysis as well as during the documentation of its results, the framework of analysis was continuously assessed. Several weaknesses were detected. It was often difficult to code the interview data so that different matters could be placed unambiguously under the relevant information quality dimensions. It was also felt to be difficult to document the results for this reason. Sometimes, it was even problematic to place matters under the six stages of analysis. The overlap in the stages of analysis, dimensions of information quality and presentation of the results was disturbing. However, coding checks were made, and after careful considerations of the usability of the framework, the conclusion was that this was inevitable in an investigation of the present kind to get a comprehensive picture of a complicated phenomenon and things related to it.

The framework of information quality analysis in its present state (Table 7) was perhaps somewhat too thorough for the virtual network environment – especially as there were many networks that were looked into. In future studies, the number of information quality dimensions for the six stages of analysis could possibly be somewhat lower. This is also related to the fact that the whole entity of information quality analysis as undertaken in the present dissertation – from the categorization of types of information to an investigation of bottlenecks of information flows – and from an assessment of the relevance of the different stages of analysis to undertaking the six stages of analysis – and finally, an investigation of network collaboration, is quite profound.

Or, in its present multi-faceted scope, the information quality analysis may be better suited to an assessment of information quality in a smaller organizational context. Alternatively, the information quality analysis could be utilized in a study of a few service chains of customers of one virtual network (for instance, subscription chain, installation chain, communication chain, alarm chain and repair chain) and/or of a few collaboration partners ('chains' of negotiations, closing of contracts, initiation of operations, alarms, communication and so forth).

It is argued, however, that the above-mentioned shortcomings do not devalue the methodology developed. Obviously, in a dissertation, it should be better to perform an analysis for the first time in a slightly too thorough way than in a way that is superficial and omits important parts. If necessary, the framework of analysis can – on the basis of this assessment – be streamlined for future research. Again, the flexibility of the framework needs to be emphasized.

The information quality analysis as undertaken in the present dissertation enabled a versatile investigation, and it is regarded as a key to practical development work in organizations. Even the certain degree of repetition across the stages of analysis and information quality dimensions seemed meaningful, because at each stage, new insights were gained, and the area of information quality was well gone through.

Further strengths were also detected. The wealth of interview data and other materials on a very complicated environment were systematized to an extent where *information quality planning* by organization or network has become possible. The value of the analysis is also supported by the fact that it is grounded on a solid theoretical basis – and the present dissertation was the first attempt to study information quality in the branch

of safety telephone services in Finland, or elsewhere, to the author's knowledge. It is argued that information quality required quite detailed attention in order to contribute to the basis of safety telephone services – and, on the other hand, to avoid furthering information overload (cf. Wilson, 2001).

Very importantly, the information quality analysis seems to provide results that could be utilized in individual organizations' quality management systems. It is argued that the information quality analysis could form one element of a general quality assessment at organizational or network level. However, the analysis is applicable immediately even without quality management systems – there are many uses for the valuable results.

The investigation of network collaboration complemented the information quality analysis in an important way. It highlighted issues that had not come up or had been merely touched upon in the information quality analysis. Yet, they affect information flows and quality. The network collaboration perspective also led to fuller use of all the valuable interview data. It showed how by simple mind-mapping techniques, richness in the data can be observed and captured to form an important basis for action scientific recommendations.

It is thus argued that the linking of previously distinct research areas – information quality, network collaboration and information flows – was successful. The results of the investigation of network collaboration were naturally branch-specific, so no arguments about their wider applicability and significance can be made. Their potential impact on development of the branch in question is significant, however. In addition, closely related branches developing distance care arrangements may benefit from the results.

7.1.3   Relation of findings to previous studies and theoretical backgrounds

The approach to information quality analysis was new in the present dissertation, and the results are original. They cannot be compared as such to the results of earlier information quality studies. The present dissertation contributes to the understanding of the information processes of virtual networks of different kinds of service organizations. During the research process behind this dissertation alone, it has become evident

that such new organizational forms have continued to grow within safety telephone services. The dissertation also confirmed that management of information is key to their success.

Traditionally, information flows have been a background factor in studies of operations of company networks, but it became clear that the approach chosen in the present dissertation – emphasis on information quality – is particularly meaningful in the case of safety telephone services. The research process and the results of the analyses confirmed that the theories chosen for the literature review were relevant ones. A review of theories on information management, knowledge management, organizational communication, virtual teams and network management as well as innovations provided a solid basis for the present dissertation. Many connections between the findings of this dissertation and findings of earlier studies were discerned, although the research approach did not contain any testing of hypotheses.

Information was in the present dissertation understood as both an act (a process) and a product (or a deliverable). These approaches stem from communication theories, systems theory and discussions of information quality. A further approach to defining information that is essential for this dissertation came from studies of organizational communication. Information – verbal and nonverbal – is the basic raw material of communication.

The findings of the present dissertation supported the claim that the need to draw a definite line between knowledge and research on knowledge management, on the one hand, and research on information and information management, on the other hand, is too emphasized. When information management is understood from a larger perspective than the traditional information systems and information technology perspective, knowledge and information management are intertwined. This dissertation was based on the view that one can concentrate on things other than information technology solutions when speaking of information and information management.

The findings of the present dissertation also demonstrated that the quality of information cannot be improved independently of the processes that produced this information and of the contexts in which information is utilized (Strong, Lee and Wang, 1997a) – and vice versa; that is, contexts and processes of safety telephone service networks cannot be improved independently of the quality of information.

The present dissertation contributed to the so-called information product approach to information management (Wang, Lee, Pipino and Strong, 1998) within safety telephone services, as it facilitated (i) understanding of consumers' information needs, (ii) managing information as the product of a well-defined production process and (iii) managing information as a product with a life cycle. Wang et al. (1998) noted that a poorly defined information production process is likely to lead to, for instance, updating of customer information on an *ad hoc* basis when convenient. That was also confirmed in the present dissertation.

Development of methodology in this dissertation was based on Wang and Strong's (1996) hierarchical framework with four data quality categories and fifteen dimensions. When choosing the appropriate approach for studying information quality, type of network and phase of network's development need to be considered. The present dissertation developed a framework of analysis that was designed for established safety telephone service networks, where an assessment of existing practices was essential.

Daniels, Spiker and Papa (1997) suggested that it would be useful to extend the study of information adequacy beyond the needs of individuals as information receivers. In their view, we need to know more about the ways in which system and subsystem information needs are defined, and how these needs are fulfilled through organizational communication. These needs were also addressed in the present dissertation; information quality considerations were a logical step there.

As noted by Tuomi (1999), people are starting to understand that knowledge management is about time management and about trust management. The results of the present dissertation implied that these two types of management are also important in virtual service networks. Moreover, it has been suggested that in order to integrate knowledge into management, managers should ask: "What do my employees need to know to make the best decision?" The author of the present dissertation argued that information quality is very much related to this question, which was also confirmed by the findings of the dissertation.

Organizational communication

Organizational communication was an essential topic to discuss. The way in which activity is transferred into actions and operations depends on our

knowledge structures. The present dissertation contributed to finding out about impediments to action and to relationships, leading to poor communication.

Trustworthiness and appropriateness are, according to organizational communication theories, essential in successful communication. Their relative importance may depend on the precise communication goal. Relationships build trust – the confidence that the receiver will fulfil obligations and behave in a fair and predictable manner. Communication is more effective when trust and commitment are high. These findings of earlier studies were confirmed in the present dissertation. Trustworthiness and appropriateness are concepts different from the information quality dimensions utilized, but closely related. It was also shown in the information quality analysis that the relative importance of different information quality dimensions depends on the communication goal (here reflected by the four different types of information).

On the other hand, the results also gave support to the earlier finding that faulty communication and unsuccessful interaction make it impossible to reduce psychological distances between people. Thus, mutual understanding and relationship are intimately related. The present dissertation also addressed in a general manner all the three elements of the communication process: (i) the communication strategies for a given communication goal, (ii) the medium by which the message is transmitted and (iii) the form in which the information is packed into a message.

The four broad social processes that require communication, (i) reaching understanding, (ii) coordinating action, (iii) building relationships (socialization) and (iv) strategically influencing others were all found to be relevant in the present dissertation. Contextualization that requires the sender to build an explicit interpretation of the issue as opposed to noting only the desired reaction or core message also seems relevant within well-functioning safety telephone services.

The information quality approach taken in the present dissertation is related to the issue of control in communication theories. Control can take the forms of (i) planning the pattern of communication, ahead of the process and (ii) testing and adjusting based on feedback during the process. A particular characteristic of control through planning is the clear designation of who does what in the communication process and a distinction between plan and implementation. On the basis of the findings

of this dissertation, it appears that both forms of control could be facilitated through the information quality analysis.

Perspective taking in communication can be demonstrated by taking interest in the receiver's viewpoints, inquiring about their affairs and attitudes and supporting them. The results in the present dissertation showed that these would be important in virtual networks, but have barely been taken into account. Communication complexity plays a major role in the choice of strategies because it reflects the plausibility of errors or difficulties in communication, and on the basis of the results, it can be argued that communication complexity is high in safety telephone services due to their particular characteristics.

The results in the present dissertation are also related to the degree of message organization – the extent to which the message is systematically ordered to support mutual understanding. There were found to be problems in this regard, but the information quality analysis could facilitate creation of highly organized messages in the future. For instance, the information quality analysis of alarm information showed that a familiar or standard format for immediate recognition had not been defined for the distance from the call centre to safety helpers. In communication theories, it is argued that message organization becomes profitable when the effectiveness gained in terms of reduced complexity outweighs the usually substantial effort involved. It appears, on the basis of this dissertation, that more systematic procedures for the transfer of information would, indeed, outweigh the effort involved – as that does not even seem to be substantial.

Communication is shaped by senders and receivers. It is likely to be affected by their individual styles of information processing. It may be even more important, however, to discern the relative characteristics that create a distance between the sender and the receiver. The present dissertation discerned characteristics of the information processes, different networks and safety telephone services that introduce variations in the communication process. In the chapter on recommendations, there are some suggestions as to how distance between senders and receivers could be overcome. The results showed that in safety telephone service networks, there is both psychological distance (due to, for instance, different organizations and professional groups) and physical distance (in larger networks).

When communication diverges from mutual understanding, a shared context needs to be created. In contrast, communication between established work groups can be less explicit without hindering mutual understanding. Cognitive distance coupled with low trust reduces the likelihood of information exchange where it is most needed. All these findings from earlier studies are also related to the findings of the present dissertation. A shared context seemed to be missing from, in particular, the larger networks. Established work groups seem almost impossible to create, as there are so many actors involved in safety telephone services, and the personnel changes. This highlights the importance of explicit communication.

The present dissertation investigated virtual networks, where trust is crucial. In studies of virtual organizations and virtual teams, it has been found out that it is more difficult to develop trust between people who hardly ever meet. Thus, communication is expected to play a growing role in promoting not only task-oriented goals, but also relationship-oriented ones. The present dissertation has shown the importance of this in safety telephone service networks and confirmed that in today's situation, it is more effective and relevant to facilitate human communication in these networks than delegate communication to machines.

Network management: Virtual organization and virtual teams

In large safety telephone service networks, there were found to be clear characteristics of dynamic networks, as described by Ståhle and Grönroos (1999). It may be so that 'management' of very large safety telephone service networks has, indeed, become an illusion. A company is to be seen as a tridimensional system with a mechanistic, organic and chaotic character. Good examples of organic action that aims at controlled development are quality management systems. In the present dissertation, the emphasis was mainly on organic action – the information quality approach is intended to contribute to action striving at controlled development, sufficient stability and foreseeability. Safety telephone service networks were found to be apposite examples of dynamic structures, where – on the other hand – an increasing part of the operations is based on spontaneity and *ad hoc* decisions: a good sense of situation and an ability to react quickly (cf. Ståhle and Grönroos, 1999).

Many findings of the present dissertation were closely related to earlier findings of studies of virtual teams: creation of trust from scratch as part of

relationship building as well as importance of face-to-face contacts, of initiating the connection to new members of networks and of member support in virtual teams including active participation, loyalty and true commitment to team and tasks. As in virtual projects, it was found in this dissertation to be very important that each of the network (team) members share the same goal. Everybody has to understand the goal similarly.

The results indicated that many of the suggestions given by Jarvenpaa and Leidner (1999) – and others – for virtual team managers and members could be repeated in the recommendations of the present dissertation. This dissertation showed the importance of, for instance, (i) defining responsibilities clearly, both in terms of what and when to do, (ii) setting guidelines on how often to communicate, (iii) ensuring that members share the common goal, (iv) being aware of your impact on others and (v) integrating team needs with organizational needs by showing the linkage to other tasks. The present dissertation also showed how essential it is, inter alia, to (i) engage in communication at an early stage of the operations, (ii) provide feedback to others and (iii) pay attention to quality and predictability matters in communication.

Innovation theories

The findings of the present dissertation were related to innovation theories. Innovativeness is inherent in well-being technology and new, developing ways of using it. This dissertation indicated that new kinds of organizational networks require process innovations as well as the activity of committed individuals in order to function well and correspond to the needs and requirements of customers.

The findings of this dissertation pointed to the need of process promotors and relationship promotors within safety telephone services – and virtual networks more generally. The results also implied that there are many potential sources of value innovation within safety telephone services. They are brought up in the recommendations. Should new thinking beyond existing assets and capabilities be adopted, ageing customers could obtain completely new kinds of 'total solutions', increasingly 'personalized' services. This dissertation also supported the argument that in a service network, it is the people who count, their service attitude and qualifications, and those things are difficult to imitate. It is quite true in care-related work.

The findings of the present dissertation further supported what has been found out in studies of knowledge management: an organization does not become more 'knowledgeable' by adding knowledge products on top of it or by providing employees with 'the best information available'. Information and knowledge are integrated into social processes, and information or knowledge products are catalysts for organizational learning processes. Even a highly structured database of addresses, for instance, is just a pile of paper, if it is not connected into organizational information and knowledge processes (cf. Tuomi, 1999). These considerations also guided the formulation of the somewhat unusual research design of the present dissertation.

This chapter focused on connecting the findings of the present dissertation with the findings of previous studies. They were emphasized because in the operationalization of the framework of information quality analysis, earlier studies and theoretical backgrounds were hardly mentioned at all – although they lay part of the foundation for this dissertation. On the other hand, the results of the information quality analysis and network collaboration are so extensive that they were only referred to here – with regard to their significance – and their reliability and validity are subjected to a separate 'quality control'.

8 Quality control of the dissertation: Validity and reliability

8.1 Queries and checklists

The present dissertation was based on methodology development as well as case studies in several safety telephone service networks. It provided a more comprehensive understanding of (i) the operationalization of the newly developed framework of analysis of information quality and (ii) network collaboration within the branch in question than a single case or comparative two-case studies would provide.

There were, however, many potential sources of bias and invalid qualitative interpretations. According to Miles and Huberman (1984), there are no stiff rules in qualitative research for indicating whether findings are valid and procedures robust – for knowing how good a piece of work is. They listed 50 queries that can be fruitfully posed when reflecting on the above question. The queries are divided into the following categories:

- objectivity /confirmability,
- reliability /dependability /auditability,
- internal validity /credibility /authenticity,
- external validity /transferability /fittingness,
- utilization /application /action orientation.

The queries have been taken into account during the whole research process and its documentation, and they are considered in the following assessment of reliability and validity. Miles and Huberman's list of queries is particularly comprehensive, which is why it was chosen for the present dissertation. Usual assessments of validity and reliability in, for instance, doctoral dissertations do not address such a wide-ranging and detailed list of issues.

There are also numerous other typologies of validity, containing, apart from internal and external validity: face, content, convergent, discriminant and predictive validity; natural validity; criterion-related and construct validity; theoretical validity; pragmatic validity and evaluative validity (see, e.g., Miles and Huberman, 1984; Bohrnstedt, 1983; Maxwell, 1996; Kvale, 1989). Reliability, again, has been divided – apart from internal and

external – into diachronic, synchronic and quixotic reliability (Kirk and Miller, 1986). Most of these are also covered within the following assessment.

Miles and Huberman (1990) developed a shorter checklist that can be used for testing and confirming findings and conclusions. This checklist includes twelve tactics:

- checking for representativeness (for example, are the interviewees typical; what is the representativeness of the data),
- checking for researcher effects,
- triangulation (for instance, do data include different methods and different hierarchical levels; are there different sources of evidence),
- weighting the evidence (for example, informants and circumstances of the data collection),
- contrasts /comparisons between two sets of things,
- checking the meaning of outliners (for instance, are there any exceptions),
- using extreme cases (for example, are there any extreme situations or persons),
- ruling out spurious relations,
- replicating a finding,
- checking out rival, alternative explanations,
- looking for negative evidence,
- getting feedback from informants.

These tactics are also incorporated into the following assessment. There is some overlap in the different parts of the assessment due to the close natural link between validity and reliability. The following detailed account reflects the importance placed on a careful quality control – especially in a dissertation related to one aspect of quality. These matters often receive far too little attention, even in doctoral dissertations (e.g., Tuomi, 1999).

8.2 Objectivity /confirmability

Objectivity and confirmability are related to relative neutrality and reasonable freedom from unacknowledged researcher biases. The domain may also be labelled 'external reliability', and the emphasis is on the replicability of the study. (Miles and Huberman, 1984.)

General methods and procedures. General methods and procedures of the present dissertation were described in detail in the chapters on methodology and development of the framework of information quality analysis. The actual sequence of how data were collected, processed and condensed was outlined. This should provide a sufficient 'audit trail' (cf. Miles and Huberman, 1984) for replicability by other researchers. Special attention was paid to the explicit link between conclusions and displayed data.

Awareness about biases and assumptions. The objective of this dissertation, development of a new framework of analysis for information quality and its verification, was explicit and perhaps less vulnerable to personal assumptions, biases and values than, for instance, a qualitative study testing hypotheses might be. However, the points where special self-awareness and care were needed are:

- Design of the framework of analysis for information quality:
    - Are the six stages of analysis meaningful?
    - Is the matching of information quality dimensions with the six stages of analysis correct?
    - Is it useful to combine Wang and Strong's framework with the six stages of analysis?
    - Does this design make a distinction between information itself and context dependent elements, as expected?
    - Does this design address the question about information as an output and a process, as expected?
- Can the framework of analysis be operationalized in a meaningful way?
- Does the discussion on network collaboration add value to the analysis?

These questions were given due attention in the introduction of the framework of analysis and later on. Behind the writing of this dissertation is the understanding of validity and reliability as *processes* of checking, questioning and theorizing (cf. Kvale, 1989).

Rival conclusions. In this kind of a dissertation – where the findings were classified according to a framework of analysis and complemented with an investigation of the environment (network collaboration) – checking out alternative explanations or rival conclusions is not well applicable. One plausible rival conclusion would be that the framework of analysis for information quality that was developed has poor usability and applicability.

Those issues were explicitly considered, and future research is also needed for further verification.

Checking the meaning of outliners. There were no significant outliners or exceptions in the data. There was certain variation in the results between the different types of networks, but they were reported in the results.

Looking for negative evidence goes beyond looking for outliners or alternative explanations (Miles and Huberman, 1984). In the present dissertation, all the data support the conclusions. Again, this is partly due to the approach; this dissertation does not report results and conclusions that would, for instance, confirm hypotheses, but it captures the complexity of the studied phenomena and structures the analysis in a systematic way.

If the interviews had been structured strictly according to the framework of analysis for information quality, the results would likely be different. For instance, Wang and Strong (1996) identified attributes of information quality that were important to information consumers by collecting information quality attributes from information consumers as well as importance ratings for these attributes, and by structuring them into a hierarchical representation of information consumers' information quality needs. A somewhat similar approach was considered for the interviews of the present dissertation, but the researcher inferred that this would likely lead to spurious results and explanations. During the interviews and the feedback process, it became obvious that this inference was most probably correct. The topic of information quality with the various quality dimensions is not well-known among the targeted network participants. A good understanding would be important (cf. Kumar, Stern and Anderson, 1993) – and constructing the interviews on unfamiliar concepts could have caused confusion and ambiguity. Quite likely, it would also have increased researcher effects and led to many missing answers.

On the contrary, interviews that followed a structure that did not need many explanations and clarifications from the researcher and concerned relatively general issues (Annex 1) produced rich data that enabled the utilization of the framework of analysis for information quality. Questions about information quality dimensions and their importance ratings, for instance, would produce data also for a quantitative analysis. The timing may be right for that in another branch – that is a possible issue for future research. Even in that case, the investigation should start or at least be complemented by a qualitative analysis, including a look at collaborative

arrangements and the environment. In the present dissertation, the approach chosen was regarded as ethically correct and 'sustainable'.

A further justification for the approach of the interviews is that the interviewees, who were experts in their field, act largely on the basis of 'models' that are built on intuition and experiences. Their multi-faceted knowledge capital is such that it is likely very difficult or impossible to restore its elements to a former detailed state. It has been argued that if an expert is asked what her/his professional skills are based on, she/he can only explain a small part of that – the majority remains unclear to the person her/himself. The most natural manifestation of experience-based knowledge is speech, and in this present dissertation, also the experience-based knowledge was searched for to assess information quality in a meaningful way. (Cf. Ståhle and Grönroos, 1999: 90-91.)

Study data and reanalysis by others. All the study data are retained, including written materials and alike, audiotaped and transcribed interview data, notes made at workshops and seminars as well as notes on observation. A research diary functioned as the researcher's tool to keep track of what was done along the way, suggest ways of improving next steps and give reassurance about the reproducibility of the results (as recommended by Miles and Huberman, 1984). The interview and survey data collected by colleagues that were utilized as background information are also available for reanalysis.

Replicating a finding. Information quality and network collaboration were investigated in many networks. Some of the results concerning network collaboration were parallel to results obtained later by colleagues working on different topics and on the basis of different data, but related to the same overall theme of safety telephone services. These were referred to in the description of the results. However, due to the approach, development of a new framework of analysis, the tactic of replicating is not entirely applicable.

The assumption that scientific findings can be duplicated under identical conditions is actually an illusion in this kind of a dissertation. Enerstvedt (1989) contends that in both social and natural sciences, we can never avoid changes in conditions or measurements. Validity and reliability are thus related to each other in the present dissertation, and to differentiate them totally is impossible. In general, qualitative research may have more reliability than validity (Grönfors, 1982).

8.3   Reliability /dependability /auditability

This category concerns whether the process of the study is consistent and reasonably stable over time as well as across researchers and methods.

Research questions. The research questions were congruent with the features of the study design.

Researcher's role and status; checking for researcher effects. The researcher was able to spend time and discuss with employees at the company that forms the core of the nation-wide network. This was a good way to get to know people, terms and concepts. In the other networks, either the researcher or, in some cases, colleagues spent some time. This participation was likely to improve trust and openness in the interviews, as the researcher was aware of the operations and their background.

The researcher acknowledged the risk that informal methods of obtaining data may lead to superficiality. Sometimes, researchers claim to have *worked closely with* a company over a certain period, but this does not accord with the company's understanding. (Gummesson, 1991: 109.) In the present dissertation, no claim is made of having worked *closely* with the company in question, but in the researcher's view, a saturation point can be distinguished also with regard to spending time, preparatory discussions, feedback meetings, workshops and alike – not only with regard to interviews and other systematic data collection. It is argued that a researcher has to exercise time management. It seems that – particularly in action science – time management requires attention in order to contribute to applicability, timeliness, usability and accessibility of the results and conclusions to the parties concerned as well as others.

The research process of the present dissertation was completed with a clear workplan, and the process is claimed to have resulted in (i) a holistic view, (ii) a theoretical and methodological contribution and (iii) tools for practitioners. The workplan was constructed so that the interviews were undertaken halfway through the work, and after the initial data analysis, there was also time scheduled for stillness. The writing of other parts of the dissertation and interaction with professionals in safety telephone services proceeded, but the analysis was stopped for a while in order to give the data the possibility of 'speaking for themselves – of beginning to self-organize' (cf. Ståhle and Grönroos, 1999: 123). This was found to be a good way to discern surprising points of view and weak signals.

Quite clearly, the interviews also functioned as a kind of intervention, as the interviewees often indicated that they became conscious of phenomena (information management and details of network collaboration) that they had not focused on before (cf. Forssén, 2002). This 'interventionist' function may, on the one hand, increase researcher effects, as the researcher potentially has a stronger influence on the interviewee when introducing a new point of view. On the other hand, researcher effects may decrease, as attention is given to the new theme in the interviews, not so much to the researcher. It is estimated that the latter alternative characterized the interviews of the present dissertation.

The interviewees were eager to participate and acknowledged the importance of the investigation, which probably also made possible researcher effects weaker. Moreover, as the interviews were audiotaped and transcribed, colleagues had access to unanalysed data. Results and conclusions were also discussed and evaluated.

The interviewer may sometimes be seen as 'from management' or 'against management' (Sillince, 2001). This is more likely to characterize interviews within one or a few organizations, but in this case, the networks were so heterogeneous and the role of the researcher as an 'observer' seemed to be so clear that this problem did not occur. The interviewees did not seem to make disturbing assumptions about the purpose of the interview or the role of the researcher. The interviews were undertaken at workplaces, but due to the character of the investigation, this was not likely to affect trust negatively. Moreover, the operations are such that in many cases, it would have been impossible to undertake the interviews elsewhere.

Parallelism of findings across data sources. This concerns parallelism of findings with regard to informants and contexts. The time perspective was not relevant in the present dissertation, as no comparisons over time were made. The findings showed meaningful parallelism across informants. Certain differences were found between the different types of networks, but it was one of the intentions to find out whether these exist and what they are. The amount of interviews was sufficiently large; at the end, no new insights came up. The parallelism was also reflected in that way.

Specification of basic paradigms and analytic constructs. These paradigms and constructs were clearly specified. The framework of analysis for information quality and the related investigation of network collaboration were clearly connected to a firm theoretical basis.

Checking for representativeness. The interviewees were typical organizational members from different kinds of safety telephone service networks. In the case of the nation-wide network, at least two persons were interviewed in all the localities where the network was operational as in April 2002. One of these persons was usually a representative of the municipality and the other a local representative of the core company of the network. In the case of the much smaller networks, fewer interviews were undertaken but with particularly knowledgeable persons. The interviewees were typical also with regard to the types of agencies they represented, and there was no significant bias in their job types, age range or gender. The interviewees were knowledgeable, cooperative and organized sufficient time for the interview sessions.

The representativeness of the data is supported also by the notion that an investigation of the present kind with the present approach has never been undertaken in the branch of safety telephone services in Finland, and the results of this dissertation already cover networks that serve a significant part of all the Finnish safety telephone service customers (approximately 12 per cent in May 2002 and up to some 20 per cent in May 2003). The number or types of networks investigated should not have a limiting effect on validity and reliability of this dissertation. The comprehensiveness of data collection was also in line with the 'requirements' of the research questions.

Comparable data collection protocols. As background information, data collected by other researchers were utilized in the present dissertation. The data collection protocol of the researcher who interviewed customers of safety telephone services was similar to the one in this dissertation. The other researcher did a survey at a call centre. The survey results were also utilized as background information.

Coding checks were made approximately six months after the first coding of the interview data. The checks showed adequate agreement. The researcher also listened to the audiotapes of the interviews that were transcribed by a research assistant to confirm the correspondence between the tapes and transcribed data.

Data quality checks; triangulation. The data were collected from several networks. The interviewees were from different organizations and represented all hierarchical levels. Several data collection methods were used, including collection of written materials and alike, interviews, workshops and seminars with note making as well as observation. In

addition, interview and survey data collected by colleagues on other topics related to safety telephone services (customer experiences and call centre work) provided background information for the present dissertation. These data were, however, not utilized in the actual analysis of information quality and network collaboration. Interview data, the main type of data, were collected systematically by the researcher. All the interviews were audiotaped and transcribed. There was neither bias nor room for deceipt.

Use of a software tool was considered for analysing the interview data, but it was decided that handling, classifying and analysing the data manually would allow for a richer use of the material obtained through the interviews. All the semi-structured interview questions could not be used in all the interviews, because the organizations, networks and job types of the interviewees varied. It was necessary for the researcher to be sharp-eared and sharp-eyed to 'read' the situation and adjust the interviews as necessary (cf. Gummesson, 1991). Despite these small differences, the analysis of the data followed the same procedures. Interviews were a feasible – in fact, the only fruitful – method for the present dissertation, where the aim was to uncover new clues and open new dimensions (cf. Burgess, 1991).

Although the networks that were investigated were in many ways very different, the interviews were sufficiently many to bring up their similarities, too. This reinforces the reliability of the conclusions. Note making during meetings, workshops and seminars by the researcher resulted in a research diary that has functioned as a personal, descriptive tool contributing to the analysis. The secondary data – written materials, statistics and alike – supported the analysis and findings.

Peer or colleague review. The interviews were often undertaken by the author of the present dissertation alone, but the results and conclusions were evaluated and discussed with colleagues and collaboration partners in joint meetings and workshops. This confirms also the internal reliability of conclusions. In addition, external reviewers have evaluated the approach and results of the dissertation positively in the review process of articles that have been submitted to scientific journals (Melkas, 2004a; 2004b).

8.4   Internal validity /credibility /authenticity

Do the findings of the study make sense? Are they credible to the people I study and to my readers? Do I have an authentic portrait of what I was looking at? (Miles and Huberman, 1984.) These are the relevant questions behind this category.

Meaningful descriptions; sensible accounts. A relatively general description of the contexts in which information quality and network collaboration were investigated was given in the present dissertation. The 'context-richness' of the descriptions could be better, but they were written so that the confidentiality of the interviews could be respected. Should the networks be described in a very detailed way, confidentiality could be endangered in a small country like Finland.

Miles and Huberman (1984: 279) note that the account of research should "enable a 'vicarious presence' for the reader". The present research process with the interaction with practitioners in the safety telephone service branch has clearly shown that the findings of this dissertation are credible and sensible in their opinion. The findings as well as the approach of the dissertation have been seen as a convincing way to systematize the complex information processes within the heterogeneous networks. The question of whether the dissertation actually enables a vicarious presence for the reader is, however, partly beyond the author's good intentions in that it requires views of different kinds of readers; other researchers, informants, policymakers, managers and the public.

Converging conclusions through triangulation; coherent findings. Triangulation through several data collection methods resulted in a comprehensive set of data. The other types of data supported the analysis of interview data, and the feedback process among interviewees contributed to validating the results. According to Miles and Huberman (1984), using extreme cases is one style of differentially weighting evidence. In the present dissertation, the pilot project testing new technology in small towns and in the countryside that was investigated for comparison had quite a different starting point from the rest of the networks, but it is doubtful if it can be seen as an 'extreme case'. What would constitute extreme cases within safety telephone services? It seems that the networks included in the present dissertation already reflect the variety within the branch, and still, the internal coherence of the findings is perceived to be good.

Links to prior or emerging theory. The framework of analysis for information quality was anchored on previous studies of information quality, particularly those done at Massachusetts Institute of Technology. The presented data were thus well linked to categories of prior theory. On the other hand, the presented data are also well linked to emerging theory in that the present dissertation contributed to development of meaningful qualitative methodologies for studies of information quality. The measures reflected the constructs in play, again thanks to the strong link with previous research studies. Prior theory on, for instance, networks and virtual teams also gave a strong basis for the investigation of network collaboration.

Explicit confirmation of propositions. There were no hypotheses in the present dissertation, but the suggested framework of analysis for information quality can be regarded as a larger 'proposition'. Confirmation of this proposition occurred in this dissertation through its operationalization within safety telephone services.

Areas of uncertainty; negative evidence; rival explanations. These matters were discussed in the chapter on objectivity and confirmability but need also to be mentioned here. The structure of the interviews was identified as a possible area of uncertainty. The dissertation reported results and conclusions that captured the complexity of the studied phenomena and structured the analysis in a systematic way, so negative evidence was not found. The data supported the conclusions.

Informants' views of conclusions. The feedback process showed that the conclusions were considered to be accurate by the original informants. This was apparent in meetings, workshops and seminars that were arranged to present and validate the results. The intermediary research report that was sent to the interviewees in January 2003 elicited only favourable comments from those who responded. Importantly, the conclusions were considered to be accurate also by other professionals working in safety telephone services, which further increases the generalizability. The views of other professionals were also heard in meetings, workshops and seminars.

Ruling out spurious relations. The external, environmental factors were considered in the present dissertation. This kind of an investigation cannot exclude a look at the work organizations and environments. In matters related to information, it is always a question of the larger 'social ecology' of organizations – the system in which people operate. The

same applies to matters related to quality. The quality of information cannot be improved without addressing the processes in which this information is produced (or fails to be produced) and the contexts in which the users of information utilize (or fail to utilize) this information (cf. Strong, Lee and Wang, 1997a).

The relations between findings, however, were not studied systematically in the present research process, and no claim for their independence is made.

8.5   External validity /transferability /fittingness

This area concerns whether the conclusions of the study have any larger import – whether they are transferable to other contexts, and how far they can be generalized (Miles and Huberman, 1984). The combination of an analysis of information quality and a look into network collaboration was considered to improve the generalizability of the present dissertation. Maxwell (1996) namely suggests that generalizability requires connection-making between, on the one hand, described actions and interpreted meanings and, on the other hand, theoretical frameworks beyond the immediate study, to unstudied parts of the original case – or to other cases.

Characteristics of the original sample of networks and interviewees were described so that adequate comparisons with other samples could be made. The settings (networks) were described to the extent permitted by the confidentiality of the interview data. The information processes investigated were described with illustrative examples.

Diversity of sampling. The networks were theoretically diverse enough to encourage broader applicability. The number and types of interviewees also supported this. The scope and boundaries of reasonable generalization from the present dissertation were indicated in the chapter on the results (cf. Brinberg and McGrath, 1985). No significant threats to reasonable generalizability were identified. The fact that the framework of analysis for information quality was presented in a form that was designed for safety telephone services in particular could be a potential threat. This was addressed by giving a detailed account of how the framework was designed, and how it can be tailored for use in other branches or individual organizations.

Appropriateness for readers' own settings. Where identified, differences between the networks were described to contribute to transferability. A range of readers and listeners reported the findings to be consistent with their own experiences during the feedback process. The processes and outcomes described in the conclusions should be generic enough to be applicable in other settings, even ones of a different nature. This concerns, again, two things: (i) applicability of the framework of analysis for information quality (analytic, theory-connected level of generalization) and (ii) applicability across the sphere of safety telephone services (case-to-case level of generalization; cf. Miles and Huberman, 1984), or across other fields with related types of services. The transferable theory from the present dissertation was made quite explicit in the form of the framework of analysis for information quality and the account concerning the branch of safety telephone services.

Congruence of findings with prior theory. This was a potential problem. The findings were connected to prior theory on information quality, but with regard to safety telephone services, the approach was so unconventional that no prior theory exists. This is an issue for future research – to further assess the credibility of the findings. That is beyond the scope of the theory-building approach of the present dissertation.

Unobscured narrative sequences. The present dissertation contains many narrative sequences – particularly descriptive citations from the interviews. They have been preserved unobscured (as recommended by Miles and Huberman, 1984). Besides making the text livelier, in the researcher's view, they may contribute to readers' (practitioners') interest and ability to interpret the results and to apply them in practice in their own settings.

Testing and replicating the findings. The findings are to be replicated in future studies to assess their robustness; it could not have been done within the approach of the present dissertation. There is a separate chapter with suggestions on how the findings could be tested further. Replication efforts can be mounted easily (cf. Miles and Huberman, 1984).

Contrasts /comparisons between two sets of things. A comparison was made between the different kinds of networks in the present dissertation. Another comparison was made between the different types of information that are transferred in safety telephone services.

A potential weakness was that all the networks and organizations were from the same branch of safety telephone services. This was naturally deliberate, as the branch provided the field for the verification of the framework of analysis for information quality. This choice was feasible because

- The branch offers possibilities for studying developing, new kinds of networks that are often based on virtual collaboration between many different kinds of service organizations from the public, private and third sectors.
- The branch is societally significant due to the ageing of the population – and growing in importance.
- The branch is a test field for newest well-being technology.
- Due to the characteristics of its services – provision of quick help in cases of health problems or alike – the branch is particularly vulnerable with regard to poor information quality and weaknesses in network collaboration.

The branch may limit the generalizability and applicability of the results. In the present dissertation, this concerns the framework of analysis for studying information quality. However, in the description of the framework, it was emphasized that the framework was indeed adjusted to the branch of safety telephone services, but on the other hand, it was shown how the framework was designed. The framework in its basic version is thus applicable to any branch, given also the strong basis it has in previous research studies. The above list of reasons for choosing safety telephone services for the case studies of this dissertation confirms that the branch is characterised by many current trends, such as increasing networking in service production as well as virtualization and increasing variation and complexity within networks. These factors add to the generalizability and applicability despite the concentration on one branch only.

The framework of analysis for information quality was designed so that it is, on the one hand, a suitable tool for qualitative studies of information quality in different environments and branches, and on the other hand, it can be easily adjusted to specific branches. Verification within other branches and the related further discussions on validity and reliability of the framework belong in future research. The present dissertation gave the necessary information for duplicating the steps of the analysis with the help of the framework. As the framework is newly designed, no results of previous studies were available to support the findings of the analysis of

information quality and increase their validity and reliability, which was an unavoidable weakness.

8.6 Utilization /application /action orientation

Pragmatic validity (Kvale, 1989) has to do with what the study does for its participants, the researchers and the researched – and for its consumers. The present dissertation has characteristics of action science (Argyris et al., 1985; Gummesson, 1991), making it particularly important to enhance practitioners' levels of understanding and the ability of participants and stakeholders to take action during and after the inquiry (cf. Miles and Huberman, 1984).

Gummesson (1991: 81) notes that if a map did not reflect the terrain, most people would trust the terrain and abandon the map, but scientific training all too often seems to blind a person to nature. A scientist may give up the terrain rather than the map. In the present dissertation, both the map (the framework of analysis for information quality) and the terrain (safety telephone services) were given the value needed – they were considered equally interesting, equally applicable in practice and a fruitful combination. This was not regarded as contradictory to the objective concerning development of qualitative tools for information quality analysis.

Intellectual and physical accessibility of the findings. Preparation of a doctoral dissertation is governed by such a large number of rules – written or unwritten – that it is bound to be somewhat cumbersome to read, at least to practitioners (cf. Gummesson, 1991). In the present dissertation, the accessibility problem was addressed by drawing up a communication and dissemination plan as part of the research diary. This plan mainly concerns the time after the public defence of the dissertation and contains ideas for increasing intellectual and physical accessibility of the findings at two fronts: (i) anyone interested in managing information quality and (ii) the safety telephone service branch. The present dissertation is considered to contain potentially useful material for such different types of readers that a communication and dissemination plan was seen as a useful exercise. It was not done at the beginning of the research process (as should be done in a development project, for instance) but along the way, as the dissertation started to take shape. The plan utilizes the different dimensions of information quality as well as the thinking of information customer needs profiles.

Attention was paid to securing intellectual and physical accessibility of the findings also during the research process through feedback meetings, seminars and workshops as well as through wide dissemination of the intermediary report of the investigation that was written in the Finnish language.

The researcher argues that intellectual and physical accessibility of the findings is also related to their timeliness. This would seem to highlight the importance of combining carefulness in research with a systematic research process including time management, particularly within action science.

Stimulation of readers' working hypotheses. It has been suggested that the findings should stimulate 'working hypotheses' on the part of the reader as guidance for future action (cf. Miles and Huberman, 1984). The present dissertation contained generally applicable as well as highly branch-specific parts and findings. The challenge lies in bringing them up in a way that stimulates readers' thinking of, for instance, applicability in their own organizations – without ending up on sidetracks with overly holistic speculations. According to Airila and Pekkanen (2002), experience has shown that in an average doctoral dissertation, far too little space is given for discussion on the results, their significance and possibilities for action. This is perhaps no wonder, as it seems that traditionally, considerations that, for instance, cross the borders between scientific disciplines are not particularly valued. Such considerations might more likely stimulate working hypotheses, however. A researcher has a right – but also a duty – to express well-founded opinions.

Level of usable knowledge offered. There were several levels of usable knowledge offered in the present dissertation. They reach beyond consciousness-raising and the development of insight to broader considerations: a methodology to guide action, policy advice and recommendations. The findings are likely to have a catalysing effect leading to specific actions to solve problems. The findings are also likely to improve the so-called 'network consciousness', awareness of participants of their belonging to a network and of the rights and duties related to that. This, again, may 'empower' them, which is positive with regard to functioning of networks (see Forström, Kautonen and Toivonen, 1997, on the importance of the sense of equality among network participants). (Cf. Miles and Huberman, 1984.)

Already during the interviews and the feedback process, it was indicated by the interviewees and other professionals that they gained new insights into information-related matters. This is a vital first step without which development efforts may well fail. In order to assess how much different kinds of users of the findings have benefited from the present dissertation, a follow-up study could be undertaken later – perhaps even two, one within safety telephone services and the other elsewhere.

Value-based or ethical concerns. No value-based or ethical concerns could be discerned with regard to the framework of analysis for information quality or its operationalization. The branch of safety telephone services brings to mind several value-based and ethical concerns, such as the division of work and duties between the public, private and the third sectors; financing of services; privacy considerations; educational qualifications required from the personnel in these services; abilities to utilize well-being technology by ageing people and attitudes towards them as customers; integration of customers' views into development of appliances and services as well as clarification of customers' service chains. Most of these matters came up in the interviews, because they are directly or indirectly connected to transfer of information. No attempt was made to exclude them from the analysis of this dissertation. Such an exclusion would lead to a defective and misleading picture of the branch of safety telephone services. It is a branch characterized by partly conflicting interests and values (cf. Gummesson, 1991).

However, as safety telephone services (only) provided the environment for the case studies to operationalize the suggested methodology, the researcher tried to avoid raising the matters listed above *explicitly* as value-based and ethical concerns – that kind of a discussion is, obviously, beyond the scope of this dissertation. The guiding principle in this somewhat contradictory task has been to ensure that no type of actor, organization, network or sector is directly harmed because of the findings and conclusions of the present dissertation, nor do any of those benefit disproportionately (cf. Miles and Huberman, 1984).

8.7 Suggestions for additional validity and reliability considerations

It seems that validity and reliability considerations should be seen increasingly as an interesting, systematic quality control – an inherent part

of the qualitative research process. In the following, a few suggestions are presented as to how this quality control could be further developed.

Information quality dimensions as criteria for reliability and validity

It is argued that information quality dimensions could usefully be utilized as additional guidelines in assessments of reliability and validity – for instance, in combination with Miles and Huberman's five categories that were utilized in the present dissertation.

A look into information quality dimensions as criteria for validity and reliability of this dissertation shows that, for example, relevancy and timeliness of the topic are high. That was confirmed over and over again in feedback sessions, seminars and workshops in which the approach and results of the present dissertation were presented and discussed. The other information quality dimensions are also suited to validity and reliability considerations – apart from access security, which contradicts the requirements for doctoral dissertations.

It is beyond the scope here to go through all the dimensions, as a comprehensive assessment of reliability and validity was already undertaken. They could be utilized in future research – in comparison with Miles and Huberman's categories to show the similarities in detail.

9 Conclusions and recommendations

9.1 Conclusions

The objective of the present dissertation was to develop a framework of analysis for investigating information quality within information processes of networks of organizations on the basis of qualitative data – in order to contribute to development of information quality management tools. The objective contained the operationalization of the framework of analysis within safety telephone service networks. This dissertation also aimed to produce recommendations for practical development work in the networks in question with regard to information quality and general network collaboration. The research questions were related to (i) quality and content of information, (ii) management of information quality as well as (iii) management and functioning of network collaboration to support quality information.

The issues of information and information management could have been approached from numerous different angles within safety telephone services. They are listed and commented on in the following:

- An information systems perspective would not have taken the researcher very far, as we are talking about networks where an e-mail access is not the norm for all employees yet, where faxes are still used to a great extent and where even the use of computers is not prevalent for everyone. In spite of investigating matters related to well-being technology and gerontechnology, it is necessary to 'keep our feet on the ground'.
- An information flows perspective would have remained largely descriptive. The same applies to an information content perspective without the quality perspective.
- The information quality perspective is much-encompassing. The perspective of management of information quality emcompasses even more, as it requires a more comprehensive investigation of the network perspective to be able to formulate recommendations. Considerations are also claimed to remain valid in spite of increasing future use of information and communication technologies in the networks in question.

It became evident in the present dissertation that discussions on information processes within safety telephone services usually centre round alarm information. Those information processes indeed form the foundation for that service type, but little attention is given to other types of information. Information transferred within the safety telephone service networks was divided into four types: customer information, information related to alarm calls, technical information and information related to collaboration network.

The requirements for the precise contents of the different types of information vary somewhat across different types of networks – depending on their operations. For instance, in an internal system of a block of service flats, the personnel knows the customers and deals with alarm calls, so there is no need to transfer customer and network information. The four types were identified as the distinct types of information that are transferred in the networks. There are other essential types of information, such as that given to the customer and near relatives at the time of installation of the safety telephone, but they are not transferred in the networks. The present dissertation showed that certain types of information – particularly network information – may be seen as self-evident and omitted in planning, although they contribute to the transfer of other types of information.

The net of information flows is quite complicated even in only one locality. If the call centre is large and serves numerous localities, challenges are multiplied. Bottlenecks in customer information flows were found particularly in (i) flows of information on changes in customer information to all the relevant partners in the local networks and (ii) flows of information on changes in customers' health condition. Bottlenecks in alarm information flows were found in (i) between the call centre and safety helpers and (ii) information on safety helpers' visits to others concerned (such as municipal home helps). Flows of technical information were found to be relatively straightforward, without bottlenecks but challenges with regard to timing. Flows of network information are usually sporadic – if that kind of information is at all transferred. Importance of network information is not recognized properly, which results in numerous bottlenecks in its flows.

The following general factors were found to be related to bottlenecks in the flows of all the four types of information: lack of a well-defined 'methodology' for information processes, differences in local service structures, differences in service provision depending on time of the day,

collaboration between the public, private and third sector service providers as well as information quality. There are as many parallel systems as there are localities, and this makes it challenging to develop the operations towards greater systematisation and coherence, particularly within the nation-wide network.

Differences in local conditions concern the type of customers, who may have subscribed the safety telephone and service individually, at their own expense, or who have obtained the service through the municipality as part of public service provision. The type of customers – private or municipal – was observed to affect transfer of customer, alarm and network information between service providers as well as the extent of integration of safety telephone services into the whole 'service package' of the individual ageing person.

Local conditions also have an impact on who provides the actual help to the customer (municipal home help or a company providing home care, inter alia) and who is responsible for the installation of the telephone in the customer's home and the related guidance on how and when to use the telephone. Local conditions affect service provision also as those in the countryside were found to get service that is different from the services of those living in towns and cities.

Time of the day when an alarm call is received was observed to lead to differences in service provision. For instance, one day may be divided into six periods of different length in one locality, and service provision to the customer is organized differently during each of these periods. This exacerbates problems with regard to management of information flows.

The dissertation showed that bottlenecks in information flows are partly related to the 'multipolarity' of collaboration networks. Procedures for the collaboration between the public, private and third sectors remain unclear within safety telephone services. The lack of established procedures makes also contract negotiations between municipalities and external service providers demanding. Contract provisions were found to have a significant impact on information flows – they either facilitate information flows or cause extra bottlenecks. These observations are not applicable to all the networks investigated, however. Internal safety telephone systems of blocks of service flats as well as purely municipal systems in small or medium-sized towns do not encounter similar problems. Although the type of network affects many things, it also became evident

in the present dissertation that the problems and challenges in the operations are generally quite similar. Differences are found in their scale.

An important factor related to courses and bottlenecks of information flows is the quality of information itself. Improvement of information quality requires systematic attention to the content of information that is transferred and stored. A thorough assessment by network has to be made of what kind of customer, alarm, technical and network information is needed. For instance, problems are typical in the area of telephone numbers of service providers, near relatives of customers and of customers themselves. They are pieces of information that ought to be error-free within safety telephone services. In some other pieces of information, again, minor inaccuracy might be acceptable.

The network information needs of all collaboration partners of the networks were observed to be rather poorly met, particularly in the nation-wide network. Plans to fulfil those needs have not been made and implemented. This is an important finding, because smooth flows of network information were found to be closely related to flows of other types of information – in particular, customer and alarm information. The quality of information also needs continuous control after improvements have been made – this was confirmed in the present dissertation.

A coherent operational logic in arranging the networks' information processes is usually lacking. The issue has not been addressed in a systematic manner – by defining procedures, rights and responsibilities with regard to information, by finding out information needs of collaboration partners and professional groups as well as by giving attention to the quality of information. The importance of information-related issues in safety telephone services is recognized, but the area also appears to be regarded as difficult to grasp and to address in development efforts. Information processes have often been arranged on an *ad hoc* basis.

The results of the information quality analysis gave details of challenges related to information quality by type of information. Challenges are numerous indeed. The results were synthesized into a table where the importance of the different information quality dimensions investigated was evaluated (Table 13). The synthesis indicated directions for corrective actions. Measures to improve information quality are necessary at many points, but it is argued that they need not require major changes

or costly operations. It is often a question of making information and information flows visible and transparent.

The results of the analysis of information quality implied that network collaboration is a prerequisite for many of the improvements that could be done to information quality. The analysis was thus complemented by looking into the relationship between information quality and network collaboration. The following themes were discerned as central: (i) personnel in safety telephone service networks, (ii) virtual networks and trust, (iii) collaboration between the public, private and third sectors, (iv) initiation into network operations and communication, (v) installation of safety telephone and guidance on its uses, (vi) monitoring of customer's condition, (vii) customers' regional equality and (viii) strategies of elderly care. It is also essential to keep in mind that safety telephone operations and information flows boil in many ways down to customers: how and when customers use the telephone, how and when they inform of changes and what kinds of customers they are.

The present dissertation showed that the large variety of occupational groups within safety telephone services results in additional challenges of network management, which, again, leads to shortcomings in information flows and quality. In the bigger networks, collaboration partners, particularly individual employees are distant or completely unknown to each other. Organizations and individual employees in them do not sense that they belong to a network. This affects information flows related to the collaboration network, its organization of operations and changes in this organization. In virtual networks, ambiguity among collaboration partners easily arises also because of unclear responsibilities and duties related to network management.

An area affected by the unclarity in methods of collaboration between the different sectors is negotiations on contracts of purchase of services. Content and comprehensiveness of contract provisions were found to affect information flows and quality to a large extent. There is great variety in how reporting, continuous communication and orientation – factors of crucial importance for information flows and quality – are included in contracts of purchase between municipalities and companies.

Although initiation into network operations and ways of work is indispensable at the beginning of collaboration, it has not been utilized to ensure that collaboration partners 'get the picture' and can position themselves as part of the whole. Quite often, initiation is not directed to all

the necessary persons in a locality, till the end of the alarm chain. It may be too technically oriented towards safety telephone appliances and their use. The requirements of different kinds of actors within safety telephone services are not met. The initiation is also one-sided (for instance, from a call centre company to municipal authorities) instead of a mutual approach, which would be necessary.

All too often, ease of collaboration within safety telephone services depends primarily on an individual person or persons. Little attention has usually been given to ensuring continuity of smooth collaboration and sustainable development of the services. The future challenge lies in reducing the influence of mere chance and of personal relations and individual purposefulness in these virtual networks. In particular, during and after major changes in the operations, communication and new initiation have been lacking. Initiation and continuous communication would facilitate overcoming of bottlenecks in information flows, such as relaying of information on hospitalisation of a customer and on visits of safety helpers.

On the other hand, the investigation of network collaboration showed the difficulty of coordinating the variety of actors in safety telephone services in big cities. These services usually are in uncounted ways intertwined with municipal social and health care services. The number of persons who ought to be initiated and kept informed becomes overwhelming. In small and medium-sized towns and in the countryside, again, progress could be made through awareness raising and definition of systematic procedures, rights and responsibilities.

Initiation and continuous provision of information also concern customers. The present dissertation showed that the moment of installation is of crucial importance for the 'success' of safety telephone services – not only from the customer's point of view, but also from the point of view of the service system and the network – and its information flows. There are quite varied practices related to who installs the telephone to the customer's home, and how guidance is given on the use of the telephone: how and when to use it and how to notify changes. No clear procedures are necessarily defined for how guidance should be given to the customer. Within one network, different installers may have different approaches.

Service providers have different principles also concerning acute emergencies. The instructions concerning the important matter of whether

or not the customer can use the safety telephone in case of emergency – or should she/he then call the emergency number 112 – are not clear within all the networks investigated. Different instructions are given to customers and near relatives in different localities. The principles of the call centre are also often unclear to the network partners, who then give the instructions to customers. For customers and network partners alike, it is essential to know – with the lowest possible ambiguity – where to call and when. When coherent instructions and guidance on uses of safety telephones are missing, it easily results in the creation of separate, experience-based practices that vary between individual persons.

There are often problems in taking into account prerequisites for the use of safety telephone by a customer-to-be. Without a view of the whole, a telephone is easily given to a person to whom it does not suit originally or as a result of a change in health condition. Awareness of responsibility to try to avoid these situations among entire collaboration networks and among near relatives of customers requires to be raised. The issue is closely related to the need for timely and complete customer information.

Safety telephone services are hardly taken into account in today's municipal level strategies for elderly care. The strategies emphasize, for instance, matters related to construction (like institutional living). Safety telephones may be mentioned, but the effectiveness and development of the related service system are not considered. By including safety telephone services in municipal and national level strategies, improvements in cooperation arrangements of the service networks – including information transfer and quality – could be facilitated.

Those working in safety telephone services in small and medium-sized municipalities hope for broad cooperation at municipal or even regional level. There are often several parallel safety telephone service systems in municipalities – in addition to a municipal system, there may be company-operated, either local, regional or national systems, as well as services offered by non-governmental organizations or foundations. Nobody seems to have a picture of the whole. In general, safety telephone service staff is unaware of their rights and responsibilities with regard to information and about their role in the whole of safety telephone services. The present dissertation showed clearly that every employee would need to be aware of the essentials of the whole infrastructure behind the services.

9.2 Recommendations

9.2.1 Need for a reorganization of thoughts

"Communication usually fails, except by accident." (Wiio, 1978: 14)

Despite the recognized importance of information-related issues, they seem to be buried under the hectic day-to-day work in safety telephone services. Fortunately, the situation is not at all as worrying as the above quotation would imply. It has been found that development efforts in organizations are easily undermined when (i) there is not enough time to do all the work required and no-one makes a lot of noise if the work is left undone, (ii) it is not clear what to do with all the knowledge that is newly available and (iii) managing the social aspects of collaboration is not valued – these matters are just thought to slow down 'the real action' (cf. Tuomi, 1999). It appears that special care is necessary to avoid such problems when development efforts are undertaken in the safety telephone services.

The research process of the present dissertation has shown that there seems to be a need for a reorganization of thoughts within safety telephone services. The branch has undergone many changes recently in Finland – and in the near future, new changes will be caused by mobile safety telephones and other new technologies that place additional challenges on information flows and networking. It is important to see that now is the time to act and improve lines of action and procedures to prepare for these challenges. The present service systems cope with traditional safety telephones in a relatively satisfactory manner, but without tackling the problems in networking seriously, new product and service development may encounter major difficulties. This speculation is obviously not based on the results of the present dissertation, but in all probability, these changes will affect the branch to a large extent. As has been noted earlier in this dissertation, many results presented here may be of use within other types of distance care arrangements and services, which are also likely to increase. They have similar types of issues to tackle.

As to the reorganization of thoughts that was mentioned, the aim of safety telephone services by actor, organization and network should be reconsidered. Is it also in the future 'pure' safety telephone services, or are service providers perhaps considering more interactive, wide-ranging

provision of safety to individuals? For instance, call centres would not only receive calls from customers but would also actively get into contact with them. Generalizing has been usefully distinguished to 'what is' (other actual contexts), to 'what may be' (sites in the forefront of some similar process) and to 'what could be' (outstanding or ideal cases) (cf. Miles and Huberman, 1984). The above is a speculative example of a 'what could be' case.

Possibilities for interactive services or other types of enlargements of the core services depend on networks; the latter vision is probably more difficult to realize in big networks than in small, local networks. However, the present dissertation has shown that even big networks consist, in fact, of small, local networks. The first vision implies concentration on the present core competence, and the second would attempt to view a customer – a person as a whole. The latter view then contrasts with the usual planning of technology-related matters from the point of view of caregivers' needs (cf. Svenska Dagbladet, 2003). It would bring ideas from customer relationship management (CRM) into these services (e.g., Storbacka, Sivula and Kaario, 2000).

It would seem useful to take into account the future vision when planning development efforts related to information quality and networking. Whatever route is taken, information flows continue to form the basis of operations. This was confirmed also in interviews of customers of both traditional and non-traditional safety telephone services in Finland (Pekkarinen, 2003).

Another question of principle that service providers should consider is that future customers expect to be able to choose more personalized services. Today's aged safety telephone service customers are generally content with very little from the service providers' point of view. They are not active in giving feedback to the personnel even if they feel a need to do so. (Pekkarinen, 2003.) One may speculate that also the threshold of changing service providers is high for these customers – despite possible discontent. However, it appears that service providers are shortsighted if they let themselves be misled by the present situation. The branch involves quite a particular responsibility.

9.2.2   Information quality planning

The concept of information quality needs to be made increasingly visible. The present dissertation revealed the many challenges related to information quality within safety telephone services. Information quality planning would be essential at organizational and network levels to address the challenges in a systematic way. Finding solutions to the shortcomings identified in this dissertation, for instance, would be a way to start. Another possibility would be to start the identification process from scratch with the framework of information quality analysis of the present dissertation. It could be utilized as a basis for joint discussions as explained in the chapter on its applicability within other organizations or branches.

Alternatively, planning could start from simply listing the necessary pieces of information at all stages of information processes and continue by defining their necessary degree of accuracy, completeness and timeliness, for instance. Such planning is the basis for prioritisation and action. It is essential to find out about information needs of all collaboration partners as well as draw up and implement plans to fulfil those needs. They can usefully be drawn up as information customer needs profiles (Lillrank, 1997). Information has a lifecycle just like physical products (Lillrank, 1997) – in safety telephone services, this is particularly pronounced with regard to customer information as well as network information. In addition, needs of information consumers (call centre staff and network partners) change, needs of customers change, service environments change, legislation concerning these matters changes and even understanding of information quality is likely to change. These dynamics ought to be addressed to an increasing extent.

9.2.3   Suggestions for improvements in information quality within safety telephone services

First, it should be ensured that customers, their near relatives and all the participants of the service networks are informed of the importance of updating customer information. It should be made as easy as possible to send updates – by e-mail, for instance. Procedures for updating – regularly or as the need arises – should also be clearly defined, so that responsibilities are known at different levels (the customer – service provider – call centre). The extent to which updating is done should not depend too much on the customer's activity and abilities.

Second, for call centre employees, it should be easy to tell by looking at the database if and when the customer information has been updated. At the time of subscription, the information that is recorded in the customer database should also be verified, perhaps by submitting a print-out for the customer's comments. The tasks are time-consuming for the call centre or service providers, but timeliness of customer information is vital for overall service quality.

Third, all the parties concerned (customers, near relatives and all the collaboration partners) should be made aware of how giving, updating and supplementing customer information affect the services. For instance, safety telephone installers could be guided to check with the customer that the information on the customer information form is correct.

Fourthly, clear guidelines could be drafted to indicate what kinds of and how big changes in health condition should be notified, by first considering what kind of added value this would bring to the work. Large amounts of information on health condition do not appear necessary.

Fifthly, to secure high quality services, careful management of customers' expressions of consent would be necessary to enable efficient information transfer between network actors. Expressions of consent could be given at the time of filling in the safety telephone subscription form. Consent management in networks that have no common information systems or not even compatible information systems requires informing relevant network actors of the expressions of consent. Again, this implies extra work particularly for the call centre employees.

Sixthly, all the relevant actors in the network should have access to basic information about their customers so that situations are avoided where a safety helper coming to a customer's home knows nothing about her/him. Later, if common or compatible information systems are created, they can be built like information systems in hospitals, where an employee may only see the information relevant for her/his work, and a 'fingerprint' is left in the database each time the information is looked at. This is an issue for the future in most safety telephone service networks investigated – limited presently by legislation, attitudes and technical issues.

Seventhly, utilization of partly 'tailored' customer information forms could be considered – not a great variety that would lead to confusion, but, for instance, different forms for municipal (public service) and private customers within one network. Or, different forms for those customers

who are 'pure' safety telephone service customers with no other type of service and for those who benefit from a 'service package'. This might contribute to tackling some of the problems of safety telephone services that have been discussed in this dissertation.

Such a suggestion could be seen by some as contradictory to the intention to promote greater coherence in these services. However, coherence does not have to – and should not – imply that all the customers are regarded as similar. That often happens when customers are elderly people (cf. Baker, 2003). A suitable combination of 'design for all' and 'design for diversity' is needed. The service providers could look at the customer information form as a kind of 'project plan' that is updated as needed with the objective of providing safety to the customers.

Eighthly, procedures followed at call centres should be as consistent and systematic as possible. All service providers should be given a similar amount of information to ensure that they have sufficient details about the alarm, the customer and her/his health condition, but without transferring any irrelevant information.

All the corrective actions naturally need to be suited to the service environment and network in question. The above recommendations – which are not in an order of priority – are best suited to large networks in particular, networks where customers are not known. The same applies to the following recommendations concerning networking.

9.2.4   Towards improved network consciousness

"Many of the data quality characteristics are actually system requirements or user training requirements." (Wang and Strong, 1996: 23)

First, special emphasis should be based on creating and maintaining trust in safety telephone service networks. All the network partners should know that they belong to a network. They should know the characteristics of the network and rights and responsibilities related to network participation. In each individual organization, responsibilities should be clearly defined as to how and when to act in the context of safety telephone services. This concerns particularly purchased municipal services. Periodical meetings and visits should be arranged, wherever possible.

…In a way, it gives a face to the operations – that is a whole different thing than reading some papers or trying to imagine in your mind what it could be. (Representative of a non-governmental organization offering home care services, nation-wide network.)

Second, each individual organization and employee should be better aware of the impact they have on others and of the connection between their other tasks – or the other tasks of the organization – and tasks related to safety telephone services (cf. Duarte and Tennant Snyder, 2001). Every employee and organization should also pay increasing attention to quality and predictability matters in communication (cf. Jarvenpaa and Leidner, 1999). It has been noted that development of a company's innovative capacity and organizational resources is impossible without perceiving the organization as an integrated entity – a system in which every party acts meaningfully together with others (Ståhle and Grönroos, 1999). The same approach needs to be taken in the context of networks.

Third, procedures should be clarified for orientation into the methods of work of the network at the beginning of the collaboration. Requirements of all the participants should be clarified and mutual orientation arranged – not only one-sided. After the beginning of the collaboration – as major changes in operations arise – re-orientation should be arranged. In fact, the concept of continuous orientation (Åberg, 2000) should be adopted in safety telephone services – for all parties concerned, including customers and near relatives.

Fourthly, design of service profiles by size and service structure of municipality might assist call centre companies in managing service provision according to the needs of municipalities and of customers. Choosing from 'service packages' including also provisions for reporting, orientation and communication as well as procedures with regard to information management could be helpful for municipalities that do not always know what to ask for. The 'service package design' approach would also make comparison of different service types and structures easier. The present difficulties in finding out about differences and making comparisons should be relieved – whether it is an individual customer or a municipality, for instance, trying to make a choice between alternative systems, accessories and alike.

Fifthly, systematic analysis of feedback and attention to practices related to reception of feedback are crucial in order to gather information on

customers' and collaborators' views – and for quality improvement. In these kinds of services, feedback is very often related, in one way or another, to information transfer. For instance, if a customer has given feedback on a long waiting time from the moment of alarm until getting help, the whole service chain should be assessed in detail. All the actions taken should be clarified – by, for instance, the safety helper – to the customer or near relatives as soon as possible. It should also be ensured with the help of network management that all the feedback is brought to the attention of the relevant actors in the network. Analysis of feedback and assessment of customers' service chains, again, can be facilitated by means of building registers for feedback and for monitoring of actions taken by service providers. Registers also enable comparisons over time.

Sixthly, building of a network information database on the Internet, for instance, could be considered. The database would include a list of collaboration partners, their contact information, notes on changes in these, notes on feedback – possibly general news on the branch as well as on new appliances and accessories and so forth. Even a very stripped-down version with access for all the network partners for updating could bring added value without causing a lot of extra work for any party. A database with more information would perhaps bind too many resources to be cost-effective in these types of services.

Seventhly, special attention should be directed at invitations of tenders drawn up by municipalities for purchasing safety telephone services as well as at negotiations between municipalities and companies. Provisions for continuous orientation, sufficient training for all the parties concerned and reporting may otherwise be overlooked. Inclusion of safety telephone services into municipal and national level strategies for elderly care is also likely to result in improved network consciousness.

9.2.5   Avenues for future research

An obvious avenue for future research is application of the information quality analysis framework in other contexts. Besides continuous processes in organizations or networks, a possible field would be project work. The perspective could be, for instance, how to facilitate a project by applying the framework in planning information-related matters before the project has even started. The framework could then be utilized in monitoring of the project later on.

Utilization of the framework could be supplemented by a close look into individuals' relation to information, including their actions and reactions in different work situations, innovative practices, ideas for improvement of their work and management of tacit knowledge. Many of these issues were briefly touched upon in the present dissertation, but the individual level offers intriguing possibilities for further research.

The information quality analysis could also be developed to a more quantitative direction. It could be possible to construct an information quality index on the basis of the weightings concerning the importance of the different information quality dimensions. That would not have been feasible with the research design of the present dissertation, but an index could be useful as an indicative tool for practical development work in individual organizations. It could also enable comparisons over time.

With regard to safety telephone services, avenues for future research could include connections to worklife research, focus on knowledge based on quality information, focus on innovativeness as well as research on development needs and requirements at the national level (for instance, drafting of national level recommendations for these services) and at regional, municipal and functional unit levels. Leaving the network perspective aside might thus add to the understanding of the branch. At the more practical level, information customer needs profiles with the help of information quality dimensions could be drawn up for all distinguishable network partners.

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ANNEX 1: Structure of the interviews

Interview form (original in Finnish)
Helinä Melkas /April 2002

INFORMATION TRANSFER AND MANAGEMENT WITHIN SAFETY
TELEPHONE SERVICES IN A NETWORK ENVIRONMENT

Background of interviewee
- Education, profession, tasks, workplace
- Connection to safety telephone services (experiences, views)?
- Entrance to safety telephone operations: how and when?

- Which activities do you do at work?
- How are safety telephone services arranged (in the whole municipality /by the call centre company)? How many customers are there? Municipal /private? Are there several systems in operation? How much does it cost to the customers?
- Role in information transfer processes: what kind of information do you get, from whom, where do you transfer information, what do you transfer, what is missing, what would you need additionally /less from information systems /other co-workers (explicit /tacit type)?
- What kind of information triggers an activity /a process? What kind of information justifies which activity?
- How does an activity triggered by an event proceed in the organization /in the network?
- Installers etc.: What do you do in the customer's home? What kind of information do you give? Were you trained to for this? Is there someone else doing the same (a substitute)?
- With whom do you collaborate? How much /how? Are they municipal employees /company employees /other? With whom exactly?
- Do you know about present situation at the call centre company? Do you know about activities in other localities? Do you need this kind of information? How often /how?
- Is the municipality regularly informed of new customers? How /by whom?
- What kinds of technical appliances or applications are utilized in your safety telephone services? How do you see their role in future services? To whom are they suited /not suited? What kinds of problems do they possibly cause? Are well-being wristbands utilized?

How about in your own work? How do you communicate with collaboration partners (e-mail…)?

- Organizational priorities /motivation: Are problems in information transfer brought up in the organization /with collaboration partners? How? Why? Who has brought them up (motivation)?
- Have advantages of improved information transfer been discussed? (For instance, improved service quality, improved accessibility to service, decrease in 'fumbling'.)
- Have there been attempts to tackle the problems? What role does information have in the general order of priority of organization's operations? How has information management been systematized?
- Has a municipal strategy concerning the services for the elderly been prepared? Are safety telephone services included? How?
- How would you develop these matters yourself? How are organizational changes and changes in the operational environment generally met among the personnel? How do the staff members see themselves in the whole of social and health care services?
- What kinds of development projects are there/ have there been (for instance, networking efforts)?
- Further details about the quality of information:
- Let's take the example of an information flow (for instance, a patient gets out of hospital and becomes a customer of municipal home care services, including a safety telephone service) and discuss the quality of information in it:
- Which are the main problems (for instance, the "system" – the length of service chains/ the customer becomes obscure or the customer process is not "owned" by anyone – or individual employees)? What kind of information remains "an island of information"? How are customers relations managed (CRM)/ services tailored?
- How would you assess information flows between service providers (flows of different kinds of information)?
- Information comes from the right source? (Finding out, defining and prioritising customer/ process/ technical requirements?)
- The right piece of information is handled? (Contextual information quality: relevance, value added, timeliness, completeness, amount of information)
- Information in the right form (content and instrument)? (Intrinsic information quality: accuracy, objectivity, believability, reputation) (Representational information quality: interpretability, ease of understanding, concise and consistent representation)
- At the right moment? (Contextual information quality: timeliness, appropriate velocity)

- In the right place? (Accessibility information quality: accessibility, security; contextual information quality: relevance, value added)
- Handled in the right way? (Accessibility information quality: intellectual and physical accessibility, ease of operation and security) (Representational information quality: interpretability, ease of understanding, concise and consistent representation) (Authority of person handling, appropriate velocity, sustainability – costs and ethical aspects)
- Further on networking: Which organizations/ persons are you collaborating with? What kind of collaboration is there? Is there face-to-face communication? Are there regular meetings/ as the need arises? With whom? How are collaboration relations institutionalised? Has orientation into the operations been arranged? How /when? Has it been given on a continuous basis?
- Who are involved in the safety telephone operations in this locality (other systems etc.)?
- What kinds of contracts are the operations based on? Are there provisions in the contracts concerning communication, reporting and orientation?
- What kinds of customer information forms do you use? Are subscriptions renewed or are they continuous?
- Do customers /near relatives receive some newsletters or some other form of communication on the services?
- Were there meetings with the call centre company earlier? Have employees of safety telephone services been invited to municipal meetings?
- How could collaboration between, for instance, company and municipality be improved?
- What kind of information would you need more? Statistics that enable follow-up and analysis of services? Other types? How often? In which form?
- How are changes in customer information notified? How about changes of locks etc.? How soon? To whom? By whom? Are customers well instructed about the need to inform and about what kinds of changes to inform?
- What kinds of experiences do the customers have (about services/ appliances)? What kinds of customers are there?
- What does the future of safety telephone services look like (for instance, possibilities of growth in the locality in question)?
- Could you suggest any other interviewees?
- Other remarks you might have?

ANNEX 2: Definitions of information quality dimensions

Source: Wang and Strong, 1996.

- **Believability:** The extent to which information is accepted or regarded as true, real and credible.
- **Value-added:** The extent to which information is beneficial and provides advantages from its use.
- **Relevancy:** The extent to which information is applicable and helpful for the task at hand.
- **Accuracy:** The extent to which information is correct, reliable and certified free of error.
- **Interpretability:** The extent to which information is in appropriate language and units and the information definitions are clear.
- **Ease of understanding:** The extent to which information is clear without ambiguity and easily comprehended.
- **Accessibility:** The extent to which information is available or easily and quickly retrievable.
- **Objectivity:** The extent to which information is unbiased (unprejudiced) and impartial.
- **Timeliness:** The extent to which the age of the information is appropriate for the task at hand.
- **Completeness:** The extent to which information is of sufficient breadth, depth and scope for the task at hand.
- **Traceability:** The extent to which information is well documented, verifiable and easily attributed to a source.
- **Reputation:** The extent to which information is trusted or highly regarded in terms of its source or content.
- **Consistent representation:** The extent to which information is always presented in the same format and is compatible with previous information.
- **Cost-effectiveness:** The extent to which the cost of collecting appropriate information is reasonable.
- **Ease of operation:** The extent to which information is easily managed and manipulated (i.e., updated, moved, aggregated, reproduced, customized).
- **Variety of information and information sources:** The extent to which information is available from several differing information sources.

- **Concise representation:** The extent to which information is compactly represented without being overwhelming (i.e., brief in presentation, yet complete and to the point).
- **Access security:** The extent to which access to information can be restricted and hence kept secure.
- **Appropriate amount of information:** The extent to which the quantity or volume of available information is appropriate.
- **Flexibility:** The extent to which information is expandable, adaptable and easily applied to other needs.