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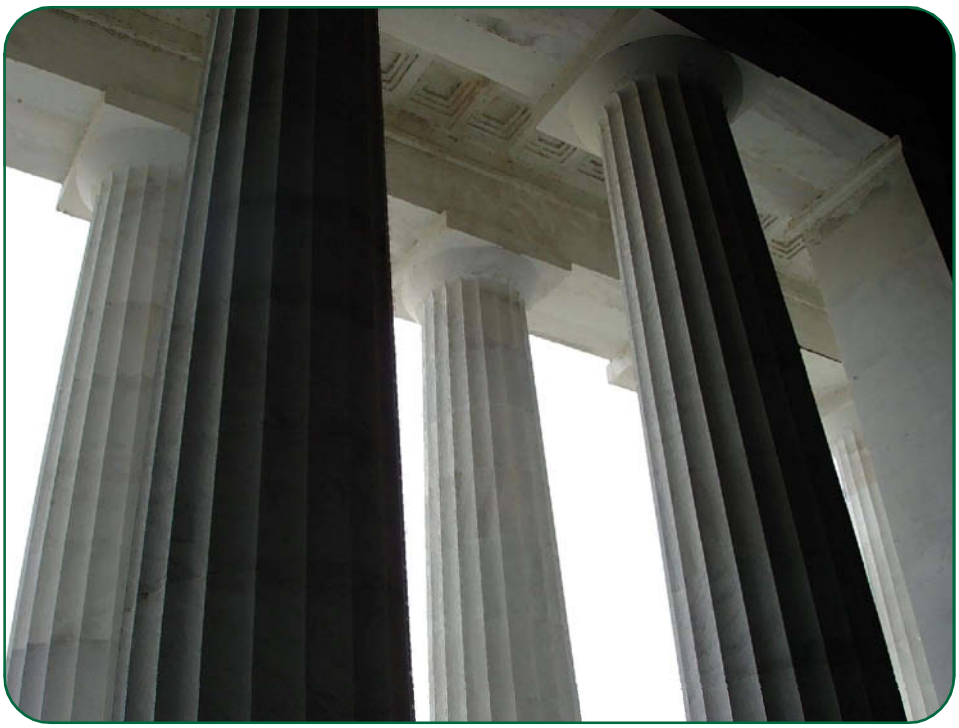

Raimo Hyötyläinen

Practical interests in theoretical consideration

Constructive methods in the study of the implementation of information systems

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Abstract

In this study, we are focusing on the practical interest in the formation of a theory. The basic issue is the relationship between practical development and research, and possibility of transcending that relationship. This dividing line can be seen to concern a knowledge and usage problem in science, which is acknowledged as a central question for theoretical consideration and practical research work. The issue is viewed from the methodological aspects of research and information acquisition. The intent is to create theoretical, methodological and conceptual research models. The objective is to use various research approaches to show the possibilities of a research-aided development process as a constructive research approach in the planning and implementation of practical development solutions, as well as in the formation of new theoretical and conceptual knowledge. The goal is to develop such methodological concepts and models – as well as research methods – through which practical studies can be conducted in the area between research and practical development. The applications discussed are the planning, implementation and use of information systems and especially enterprise resource planning systems (ERP).

The research task must be approached by means of theoretical analysis, which is focused on scientific research approaches and methods. The starting point of this study is founded on the same cornerstones as pragmatic philosophy and the concept of knowledge. To examine and create new models in this study, the following research approaches are discussed: positivism, interpretavism, action research and a constructive approach, as well as realist approaches. Through the analysis of these research approach methods, we will arrive at two scientific methods by means of which the relationship between research and practice can

be aligned in a new manner. These are a constructive approach and a realist approach.

Based on this, one can develop a research and development model in which a research-aided development process is central. With the help of this model, one can emphasize the link between research and practice, as well as the possibilities of transcending this link. The research-aided development model will be viewed separately as its own entity. As an application, we will analyze an experimental development study, as well as its methods and development cycle, which play a central role in the fusion of practical development work and research. As part of the treatment, the issues of research results and interpretation are considered.

The study will shed light on the relationship between research and practical applications from the perspective of a real example. This example pertains to technical change with associated research and development designs as well as research methods. As a technical change application, we will analyze the implementation of information systems within an organization. In doing so, we will concentrate on the planning and implementation process of information systems.

We will view the planning, implementation and use of enterprise resource planning systems using concept models and their relationships. With the help of concept models, we will delineate the planning and implementation process and its dimensions. Through this process, we will create an interaction and learning framework, including an analysis model, designed for the application of the enterprise resource planning system. For this, we will need the following concepts and models: a context model, a phase model of implementation, an implementation process model and activity model for implementation. In addition, we will analyze planning and implementation models for technical systems. Based on this, we will create a new concept, which consists of a use-oriented planning model. This model facilitates the learning and innovation processes associated with the planning, implementation and use of enterprise resource planning systems.

Based on the analysis of the phenomena concerning the planning and implementation process of information systems, we will study and analyze the creation of a research design and of how to organize the associated information

acquisition. In regard to the planning, implementation and use of the enterprise resource planning systems, we will determine a research object with associated conceptual research problems.

The research subjects, with their associated research problems, define the focus of the study. However, the practical implementation of the research requires that the research problems be broken down into research questions for which the actual research will find answers. Furthermore, the research process includes the creation of a model framework for the concurrent development of enterprise resource planning and action methods, and this model's dimensions with associated factors must be defined. Within this framework, we must scrutinize the study's information acquisition methods as well as the scope of the development work. The central information acquisition method is development group work, which constitutes an essential part of research-aided development, as well as of experimental development research. Development group work is also a central method in the development process. Other information acquisition methods are interviews, questionnaires, document analysis, the use of various knowledge bases and the preparation of different types of studies, as well as literature and concept analysis.

Preface

Issues pertaining to research and information acquisition are a central part of the research process. My own experience in research and development covers more than fifteen years, starting in 1985. Research methodological issues have been in the forefront since my work started, at that time at VTT Industrial Systems' Industrial Management Group. We have developed our own approach and method. This is a research method focusing on experimental development study, where the development cycle plays a pivotal role. The development cycle is associated with companies' development and change processes. My own contribution has been significant in connection with this research method development work, as well as in conjunction with the research and development work involving our company projects.

During the entire period we have been involved in research and development with numerous companies and have applied methods from experimental development research in developing company functions and operations. We have further developed the research methods in connection with the analysis work pertaining to the company projects and research results. Our research and development has been expanded to also cover enterprise networks and the development of business strategies. The study has also focused on the planning, implementation and use of information systems.

Concurrent with my continued studies, I have become interested in studying research methodological issues in more depth. This had already started at the end of the 1980s in connection with my licentiate thesis. While putting the finishing touches on my doctoral thesis in 1997, I started to systematically read publications regarding philosophical and methodological issues as pertaining to research and science theory. Initially, my thoughts and interest were focused on hermeneutic-interpretative starting points. Subsequently, a few years ago, when I familiarized myself with what is called the basics of realist science, I reached new conclusions. Through this process, I have started more and more to subscribe to the starting points and assumptions of pragmatic philosophy. This has also shaped my opinions about what can be accomplished by means of research and how one should view the relationship between research and practice.

I would like to thank all my colleagues in the Industrial Management Group, at VTT Industrial Systems, for their interesting and thought-provoking support. We have cooperated on many research and development projects, and, in doing so, have had lively discussions regarding research and development issues. Throughout this time, research and development approaches and methods have been under constant development.

Espoo, October 2005

Raimo Hyötyläinen

Contents

1. Introduction

1.1 Starting point of the study

Practical interests and relevance are strongly emphasized and, by the same token, acknowledged as a central issue in connection with management studies, as well as with social science research (van Aken 2004; Bruce & Wyman 1998; Easterby-Smith et al. 1991; Heckscher et al. 2003; Schein 1987; Stern 2003). However, management studies as well as social science research and their data acquisition have often been seen as a counterpoint to practical activity, based on the view of that "scientists should be detached and objective, above the battle" (Heckscher et al. 2003, p. 5; see van Aken 2004; Rosenberg 1995). Scientific research is seen as striving for "pure" truth through formal scientific methods and data acquisition based on this approach. The method used involves the description and analysis of the object, as well as the explanation of "causal relationships" based on it (see Stern 2003; von Wright 1971). The view of knowledge is that it illustrates or corresponds to something, that it is a conceptual representation of reality and that theory is a mirror image of reality (Chalmers 1999; Habermas 2003, pp. 26–30; Kusch 1991; Rosenberg 1995; Sayer 1992; Schmitt 2004a, pp. 17–28). In that case, there is a great risk that research beliefs, interpretation and speculations made on that basis will be presented as "objective truth" (Rawling 2003; Sayre 1997, pp. 33–57). In this case, one would mix reality with the interpretative side of reality (Rorty 1998; Sayer 1992; von Wright 1971).

The principal exclusion of actions completely out of sight in the research creates problems for research as well as practical change processes. In this case, social analysis does not help as much as it should in planning actions (van Aken 2004; Norros 2004; cf. von Wright 1998). Social scientists regularly commit the elementary error of assuming that analysis and the proposals as well as recommendations based on that analysis can pass directly to action. However, the implementation of proposals is another task (Nooteboom 2000). It demands to go about change in the concrete context of the organization with the differing interests of actors. It is by its nature a social process. In fact, it is assumed that the ability to act does not depend solely on the ability to understand the system on which one acts; it also depends on the ability to connect with actors in the system and to interact with them in a meaningful way (Heckscher et al. 2003,

p. 5). Secondly, it is proposed that one of the best ways to gain knowledge is to try to change things. To "understand" the system and its events, it can be claimed that the best way to make sense of social situations is often not to watch them but to act in them and then reflect on our experiences (Heckscher et al. 2003, pp. 5–6).

In particular, within the framework of the traditions of pragmatic philosophy and the concept of knowledge, the *relationship between research and practice* has been formulated in a different manner (James 2004; Rescher 2000; Smitt 2004a, pp. 3–11). The view is that the relationship between research and practical information acquisition is a fixed interactive relationship. The primary message is the functionality of research and information acquisition. Just understanding matters in a disjointed manner – removed from practice – is not enough (cf. von Wright 1998). The issue at stake is how one can use knowledge to handle various situations. In the same way, taking a realist approach, it is also acknowledged that social scientific knowledge needs to be evaluated in terms of "practical adequacy" (Sayer 1992, p. 9). The criterion of knowledge is activity in a purposeful manner and the use of the presented knowledge as an action that leads to results. A close relationship between research and attempts to solve practical problems can also be found in management studies (Eisenhardt 1989; Tsoukas 2005, pp. 94–116).

In this study, the basic question concerns the possibility of transcending the relationship between practical development work and research. However, it has been stressed that the central question in research and its orientation is the issue of what is the philosophical and theoretical foundation, and methodological starting point of the study (Ghauri et al. 1995; Habermas 2003, pp. 1–49; Psillos 1999; Rosenberg 1995; Sayer 1992; Strauss & Corbin 1998). It can be claimed that the interesting nature and significance of a research problem alone are not enough to guarantee a successful study or even practically functioning results (Easterby-Smith et al. 1991; Hutchel & Molet 1986; Turner 2003). In this study, the basic question is considered through different conceptual worlds.

That withstanding, the starting points and organization of research and information acquisition are not uncontroversial issues. As well, within the framework of pragmatic traditions, there are different views on the approaches of research (Rescher 2000; Schmitt 2004a; cf. Rosenberg 1995; Gomm et al.

2000; Ghauri et al. 1995; Kusch 1991). In this study, we will formulate *a question of practical interest in theory formation and scientific approach methods*. The assumption is that constructive methods and the analysis based on them provide solutions for a new model of the relationship between practical development and research. Here, we will question the ideal, presented by Descartes, of "pure rationality" as separate from activity, which is an approach that philosophical research has started to emphasize more (Bhaskar 1997; Devlin 1997; von Wrigth 1998). Further, in management studies, as well as in organizational research, this logico-scientific mode emphasizing universal knowledge has been questioned. The logico-scientific mode has been seen to construct idealized models of the phenomena under investigation, which are a-contextual and a-historical. An alternative stance to the objectivity of knowledge comprehends the subjectivity of an agent as a prerequisite for his construction of an objective world in a communicative interaction (Tsoukas & Hatch 2001; Norros 2004).

In this study, the formation of a relationship between practical development and research is approached by means of the analysis and development of *constructive methods*. The practical venue for this analysis is formed by the planning and implementation of information systems within an organization. The foundation of this study is a view of research activity that is based on the pragmatic tradition (see Rescher 2000; Sayer 1992). The research and information acquisition design that forms the foundation in this respect can be illustrated by Figure 1.

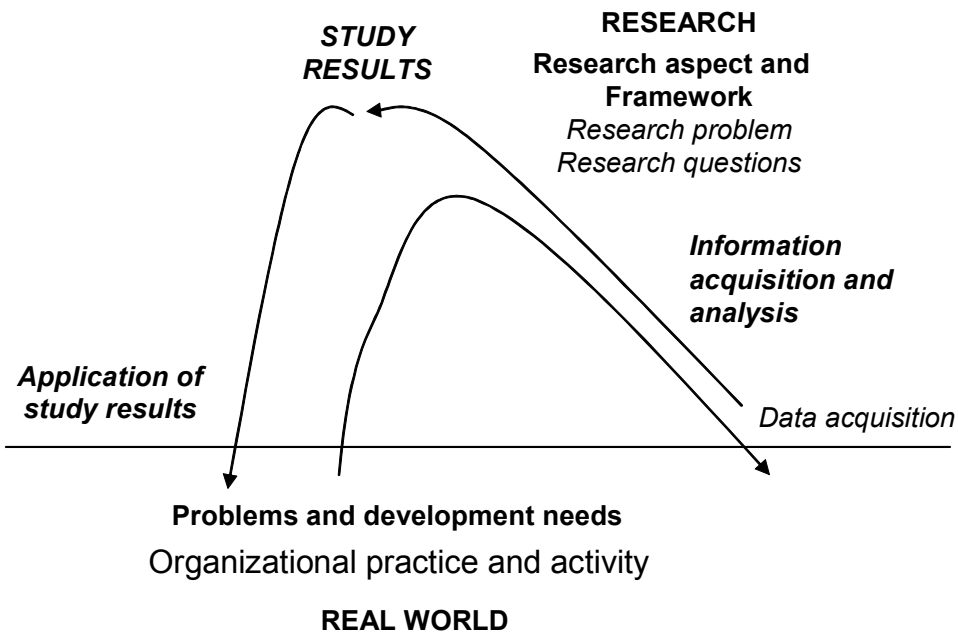

Figure 1. Research and information acquisition design according to constructive methods.

Based on the pragmatic approach, the starting point for research and information acquisition is when, in the practices or activities of the real world, there are some suspicious and problematic situations that must be addressed (Smitt 2004a, pp. 3–11; Rescher 2000). From the perspective of conducting research, it is necessary to define the perspective and frame of reference for the research on which the problem scope is based. The research has also to be linked to an earlier study and to theoretical questions posed at that time (Rescher 2000; Heckscher et al. 2003, p. 6). One could state that one should select a perspective for the study that is appropriate for the activity in question (see Kivinen & Ristelä 2001). In the study, one should approach information and data acquisition by means of scientific methods and practices. The attempt is the use of analysis of the information as a tool for facilitating a functional description of the object and to arrive at an explanation of the object's development mechanisms (Sayer 1992).

Research results are the immediate results of a study, information and data acquisition and analysis, and one must be able to justify and communicate these results. According to pragmatism, the actual purpose is the *experimental design*, i.e., the testing of said results in the intended activities and the use of the knowledge in reality (James 2004; Rescher 2000). In this manner, we will accumulate experience and arrive at a more detailed picture of causal relationships.

However, from the perspective of research and information acquisition, there will be many remaining questions, which are not self-evident. First of all, from where do we gain the research perspective and the frame of reference? On what is the selection of a specific perspective based? What kind of significance do the various perspectives have on the research and its results? How does the selection of perspective affect how the real world is viewed and what the perceived practical and functional problems are? What effect does the experimental design have on the actual research process and on the interpretation of the results? Where is the place of experimental case study in the field of information acquisition and practical development work?

These are issues to which we are seeking answers in this study. We approach issues by processing the concrete research area. The subject is the implementation of information systems within the organization. The research problems and questions are concretized in this context. This process is linked to the approaches and research methods of scientific research.

1.2 Practical aspects of the study

The implementation of information systems in an organization is a good research subject and phenomenon, which can be used to study the relationship between research and practical activities, because the implementation of information systems is a factor that extensively and deeply affects business activities and practices (Checkland & Hollwell 1998). In addition, the implementation of information systems within an organization has proven to be a process, which is difficult to handle, both from practical and theoretical perspectives (McDonald 1998, pp. 9–13; Farbey et al. 1999; Lee 1999; Rose 2002; Sarker & Lee 2002; Hong & Kim 2002; Al-Mashari 2003; Hanseth et al. 2004; Leem and Kim

2004). At the same time, the implementation of information systems and the handling of its various development dimensions make it possible for us to evaluate the significance and functionality of various research methods in developing practices and creating new concepts (Checkland & Holwell 1998; Torvinen 1999).

In practice, companies have great difficulty in implementing information systems, and, especially, in fully using all the properties inherent in the systems. In the implementation of information systems, the starting point is usuall, that, by using new systems to radically change business activity processes and the conditions on which the activities are based, the modes of operation will adapt to new conditions and, thus, the objectives can be reached (Davenport 1993; Hammer & Champy 1993). However, this approach has some apparent problems. Are there any guarantees that the systems can be implemented in a planned manner? The result can be half-baked and, if things go really badly, even worse than the starting situation (Galliers & Swan 1999; Hyötyläinen 1998; Kortteinen et al. 1996). This is affected by the fact that system implementation processes take many years and that the process will involve the participation of various parties, with different interests, perspectives and modes of operation. Within the organization, many people from various parts and organizational levels will participate in the process. In addition, various organizations will participate in the process, i.e., software suppliers and possibly consultants (Checkland & Holwell 1998; Hyötyläinen 1998; Mumford 1999). Experiences and studies also indicate that extensive information technology projects associated with the renewal of business activity processes, often fail. From an international perspective, only approximately one-third of such projects are successful (Holtham 1994; Davenport 1997; MacDonald 1998; Fichman & Moses 1999; Galliers & Swan 1999; Marchand et al. 2001, pp. 134–144; Rajagopal 2002; Doherty et al. 2003; Dalcher & Genus 2003).

One could say that the *conceptual understanding* of the planning and implementation process of information systems with associated technological and organizational development mechanisms facilitates the application of information systems in an organization and the fulfillment of the expectation focused on such implementation (Galliers & Swan 1999; Lee 1999). The implementation process of large information systems, such as ERP systems, is an interesting research subject. Due to its multi-faceted nature, the

implementation process is a challenging endeavor for researchers. In the field of research, phenomena must be analyzed by using *concepts and concept models,* because concept development is an essential matter for research agendas (Lee 1999; Al-Mashari 2003; Mähring et al. 2004; Hanseth et al. 2004). However, the implementation process of information systems is a phenomenon that is difficult to conceptualize. On a practical level, the implementation of information systems is always a question of complicated strategic issues, technical, economic and organizational problems and of defining the solutions associated with them. In addition, setting goals associated with the planning and implementation process, defining problems and creating solutions, is a kind of social process, which progresses in the form of concrete activities and actions (see Engeström 1987; Blackler 1993; Hyötyläinen 1998; cf. March & Simon 1958; Burns & Stalker 1994; Cyert & March 1992).

For this reason, we could raise a central question, which pertains to the *research and development programs* that surround the planning and implementation process of information systems. The question is what is the implementation process of information systems as a phenomenon, and which perspectives and development dimensions define the planning and implementation process of information systems. One could say that the handling of the various perspectives and development dimensions that relate to the planning and implementation process of information systems, as well as the accumulation of more knowledge about these issues, on the one hand, serves the needs of business practices, and, on the other hand, supports the creation of concepts pertaining to the application of information systems. In this study, we will approach the planning and implementation process of information systems by means of clarifying and defining the research and development perspectives (cf. McDonald 1998, pp. 9–13; Rose 2002; Hong & Kim 2002; Al-Mashari 2003; Hanseth et al. 2004; Leem & Kim 2004).

1.3 Focus and aim of the study

The basic problems in this study are what is the relationship between practical development and research, and how to solve and organize this relationship. The issue is approached in two different manners. The first one is theoretical analysis, which is focused on scientific research approaches and study models.

The other avenue is the practical focus, which pertains to technical changes with associated research and development designs and methods. As a technical change application, we will analyze the implementation of information systems within an organization.

Within the framework of theoretical analysis, the formation of a relationship between research and practice is approached by means of the analysis and development of constructive methods. The foundation discussed comprises the various research traditions and scientific approaches. *The research questions are*:

1. How is the real world viewed and how is the relationship between research and practical activities viewed by various scientific approach methods?
2. What effect does research-aided development have on practical research and its interpretation, and where is the experimental design in the field of research and practical development activity?

The practical subject is the planning and implementation process of technical systems. Through this, we will analyze the relationship between practical development and research. The specific perspective here is the planning and implementation of information systems within the organization. In this study, the application of information systems is viewed from the methodological aspects of research and information acquisition. The objective is to use various research approaches to show the possibilities of a research-aided development process in the implementation of practical development solutions and in the formation of new theoretical and conceptual knowledge. *The research questions are*:

3. What kind of phenomena pertain to the application of information systems in an organization, and what perspectives and development dimensions determine the implementation process?
4. Which planning models can be used to support the learning and innovation processes that occur in connection with the planning, implementation and use of information systems?
5. How do we gather information about planning and implementation processes, and what kind of concept models and methods do we have at our disposal for information acquisition and for formulating new concepts?

As an example of large information systems, we will analyze the planning and implementation process of enterprise resource planning systems (ERP) (Currie & Galliers 1999; Kettunen & Simons 2001; Simons & Hyötyläinen 2001; Lee 1999). A special perspective is formed by the analysis of the constructive research approach, which can also be applied in the planning and implementation process of information systems.

1.4 Research approach and method

In this study, the relationship between practical development and research is viewed from the methodological perspectives of research and information acquisition. The analysis pertaining to research and information acquisition and its methodology is based on literature studies and previous research results in this field, as well as on the studies conducted by VTT Industrial Systems (Norros et al. 1988; Toikka et al. 1988; Alasoini et al. 1994; Hyötyläinen 1998 and 2000; Norros 2004). The description and analysis of the planning and implementation process of information systems and enterprise resource planning systems are based on literature studies. At the same time, the grounds are, on one hand, the author's earlier studies (Hyötyläinen 1993, 1994, 1998 and 2000, Hyötyläinen et al. 1990) and, on the other hand, the Hanska Project conducted at VTT Industrial Systems (2000–2003), during the course of which we studied the implementation process of the ERP systems as an organizational learning process (Kettunen & Simons 2001; Simons & Hyötyläinen 2001).

The analysis of the constructive research approach, and especially the research-aided development process, as well as experimental development research, which is derived from that process, is based on extensive research activities at VTT Industrial Systems, plus on the analysis of the results from that research (Toikka et al. 1986, Toikka et al. 1988; Norros et al. 1988; Alasoini et al. 1994; Simons & Hyötyläinen 1995a,b; Kuivanen & Hyötyläinen 1997; Hyötyläinen 1998 and 2000; Hyötyläinen et al. 1997 and 1999; Simons & Hyötyläinen 1998; Kuitunen et al. 1999; Koivisto & Mikkola 2002; Hyötyläinen et al. 2004; Mikkola et al. 2004).

In this study, the planning and implementation process of information systems is viewed from a *system perspective* (Hyötyläinen 2000). The ERP systems and their

use are handled as activity systems and their planning and implementation process is analyzed as an activity, which is carried out as concrete measures and as learning and innovation functions. In this analysis, while considering the activities, we will not approach the level of the actors and their concrete measures and orientation models (see Norros 1996 and 2004; cf. Hyötyläinen 1998).

In this study, the central perspective is the relationship between practical development and research. From this perspective, we will view the interaction between change and development activities in practice and information acquisition during the study. This process is linked to the approach and research methods of scientific research. The research problems and questions are concretized in the context of the planning and implementation process of information systems. In this context, we will analyze the research and development methods, as well as create a model structure for information acquisition, and discuss planning and implementation models. In this endeavor we are supported by a new kind of use-oriented model.

1.5 Structure of the study

The study consists of two parts. The structure of the study is shown in Figure 2.

In the first part, we are discussing the approaches and study models of scientific research. In Chapter 2, we will go through the links between research work and various scientific approaches. The starting point of the study is the application of information systems as a study object. Initially, we will address issues pertaining to the application of information systems, as well as associated development characteristics. Of the research approaches and study models, we will discuss positivism, interpretavism, action research and the constructive approach and, as well as the realist approach. As far as the constructive model is concerned, we will analyze the tradition of action research. Finally, we will present as a summary a research and development model in which a research-aided development process is central. Through the model, we will emphasize the connection between research and practice. The model plays a central role in this delineation of the study, and it forms the foundation of the analyses and the modeling efforts. In Chapter 3, we are presenting a model of a research-aided development. Our analysis will

emphasize the approach of experimental development research, developed at VTT Industrial Systems, and its associated methods.

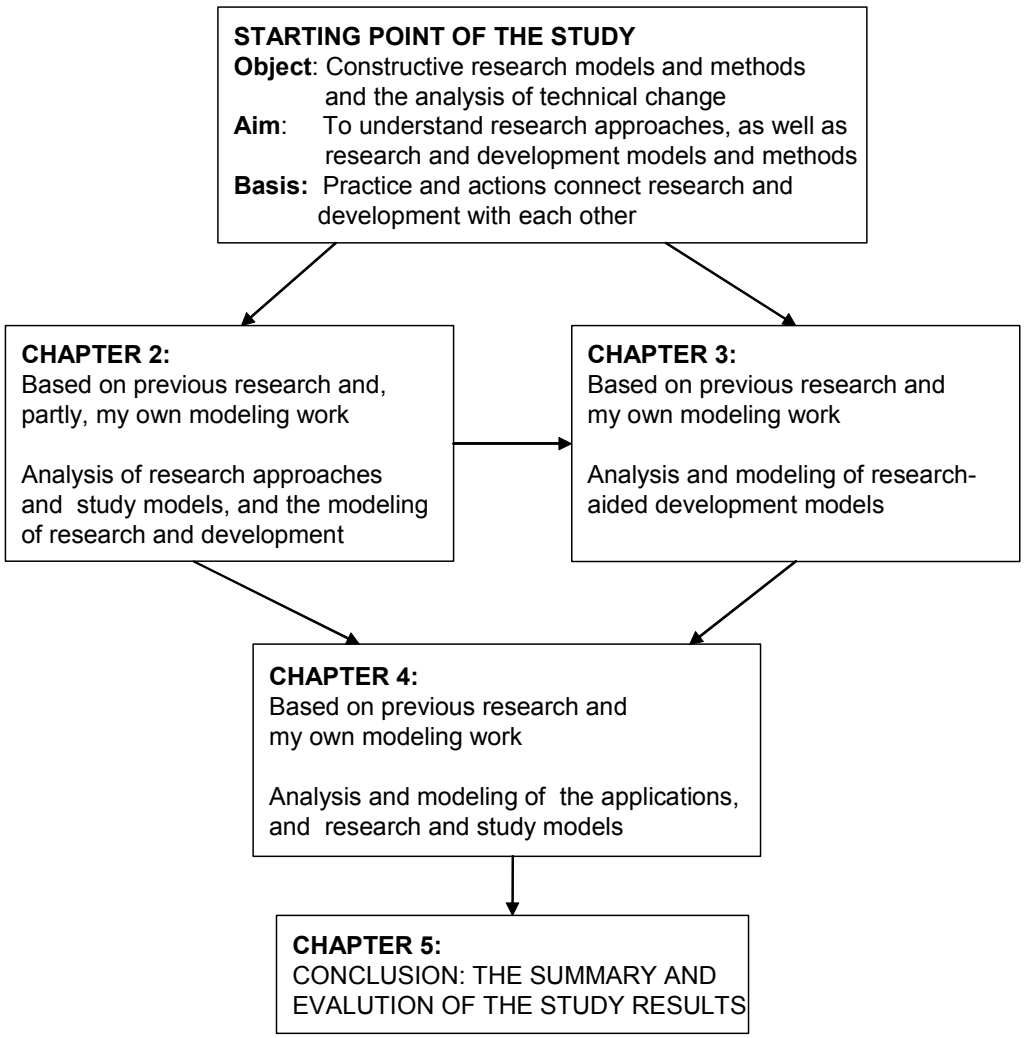

Figure 2. Structure of the study.

In the second part of the study, in Chapter 4, we will discuss and analyze study models pertaining to the planning and implementation process of the information system, in particular, enterprise resource planning systems. The starting points are research needs and study model. The model consists of three parts: implementation of technical and organizational change, planning models and

approaches, and research model and design. In the first part, in Chapter 4.2, we analyze the application of the ERP systems, and the related learning and knowledge creation processes. From this perspective, one can mention four central models. These models are the context model for the planning and implementation of the ERP system, implementation process model, activity models for the planning and implementation process of the ERP system and the cyclic model for organizational learning and knowledge creation. In the cyclic model, we will bring up the organizational learning processes, which will be viewed from the perspective of the actors. Learning can occur both within the end user company's own organization and activity, as well as within the activity of the supplier company. Learning may also occur across organizational borders and among various actors.

In the second part, in Chapter 4.3, we will discuss the planning models and approaches, included methods as they pertain to the planning of information system. In the section, we are presenting a new approach. We will present a use-oriented model as a new planning approach and concept. This model facilitates the learning and innovation processes associated with the planning and use of information systems.

In the third part, in Chapter 4.4, we will concentrate on constructive methods and on creating a research design. The research designs of experimental development research and the definition of the research objects and problems associated with the application of enterprise resource planning systems are discussed. It is necessary to formulate research questions in order to transform the research problems into a manageable form. In the section, we will discuss the formulation of research questions regarding the application field of the ERP systems, with associated information acquisition methods, and their relationship to development activities, which occur in reality.

Finally, in Chapter 5, we will present *a summary of the research results and present our conclusions* about the study. In connection with the conclusion, we will evaluate the experimental development research as part of the constructive methods. We will evaluate the research results separately. In addition, we will discuss the need for additional research.

PART I: SCIENTIFIC RESEARCH APPROACHES AND STUDY MODELS

It has been stressed that the central question in research and its orientation is the issue of what is the philosophical and theoretical foundation, and methodological starting point of the study (Ghauri et al. 1995; Habermas 2003, pp. 1–49; Psillos 1999; Rosenberg 1995; Sayer 1992; Strauss & Corbin 1998). It has been acknowledged that the validity of a study is dependant on the adoption of applicable theoretical and methodological approach methods. The question comes back to the issue of what is experienced as fact and what is considered interpretation. The issue is also about what are the study's central objectives and goals, and what is the context with which the study and its research problems are associated and how they are conceptualized (Tsoukas & Hatch 2001).

Often, the criticism voiced is related to management studies and the implemention of such projects. Criticism is focused on the researchers initiating research without first thinking of the applicable theoretical and methodological questions (Tsoukas 2005, pp. 299–320 and 321–339). The same has been found to apply also to research and development activities pertaining to the application of information systems in organizations (Checkland & Holwell 1998).

Research activity is affected by various kinds of research paradigms and the world views created by them. The dividing line between these world views makes a big difference in the research. The foundational premises being part of these world views outline and define, to a great extent, how the world is understood, and the research and its objects are conceptualized (Easterby-Smith et al. 1991, pp. 22–32; Fay 2003; Lee 1999; Rosenberg 1995, pp. 10–25; Tsoukas & Hatch 2001; Turner 2003). In management research, as well as social scientific research, theoretical and methodological issues are especially difficult. In principle, research work pertains, on one hand, to empirical and factual data, and, on the other hand, to concepts and conceptual knowledge (Sayer 1992). In different research paradigms, these relationships, and especially the role of theory in research are viewed in different ways. As well, the relationship between practice and theory manifests itself differently based on which approach is used.

In Chapter 2 of this study, we will discuss various research approach methods and research models. The primary issue is what kind of research activity we are dealing with. What starting points apply in regard to social scientific research? This analysis is linked to the approach and research models of scientific research. Before discussing the various research approaches, we will firstly, in Chapter 2, broach the issue of the application of information systems in an organization, with associated changes of focus on research and development objects, as well as research methods. After that, in the case of research models, the following research approaches are discussed: positivism, interpretavism, action research and the constructive model, as well as realist approaches. Finally, we will present as a summary a research and development model in which a research-aided development process is central. With the help of this model, one can emphasize the link between research and practical development, as well as the possibilities of transcending this link. The research and development model forms the basis of the delineation of this study and in the analysis of the practical field of planning and implementation of information systems. In Chapter 3, we will devote a separate section to the research-aided development model. Based on the developed model, experimental development research, a research-aided development model also emphasizing historical view, and its methods are outlined. The model is a modified application of constructive methods. In addition, some new demands set on the nature of the research results as well as their interpretation are concerned.

2. Research activity and study models

2.1 Practical research objects and their change: development characteristics

The application of information systems in organizations and the management of this adaptation process, as well as the associated methods, have become a separate research area (Lee 1999; Checkland & Holwell 1998; Avison & Fitzgerald 1999; Iivari & Lyytinen 1999; O'Donovan & Roode 2002). These research activities have produced a large number of research publications and information about the planning, implementation and use of information systems. In this research, the emphasis has been put on the planning and implementation processes for information systems, with associated administration methods, as well as research methodological aspects (Currie & Galliers 1999; Davenport 1993 and 1997; Checkland & Holwell 1998; Irani 2002; O'Donovan & Roode 2002; Rose 2002; Al-Mashari 2003; Pahl 2004; Ruhe 2004).

Over time, changes have occurred in the research and development work pertaining to the application of information systems, where these changes have especially pertained to planning and implementation models and to associated methods. Previously, information systems were primarily viewed from a technical and planning method-centered view. Much attention has been focused on technical choices and planning for information systems, as well as related planning methods (Avison & Fitzgerald 1999; Checkland & Holwell 1998; Iivari & Lyytinen 1999).

The implementation of an information system in an organization is a complicated process, which involves issues involving technical and organizational changes (Davenport 1993; Hyötyläinen 1998; Hong & Kim 2002; Doherty et al. 2003; see March & Simon 1958; Burns & Stalker 1994). The problem has been that, in implementing information systems, the definitions of the technical system and its requirements have been given more emphasis than the development of the organization and operational methods. The latest efforts in companies show that organizational issues are becoming more commonly incorporated into the system development process, and a goal is to achieve a balance between technical change and organizational change (Ehn 1988;

Mumford 1999; Feeney & Willcocks 1999; Hong & Kim 2002; Doherty et al. 2003; cf. van Eijnatten 1993).

The focus with regard to the development and application of information systems and information technology has shifted from focusing purely on hard technology and methods to more emphasis on soft issues (Mumford 1999; Checkland & Scholes 1990; Checkland & Holwell 1998; Rose 2002). Information technology is considered to be, by its very nature, intellectual and potential technology. This includes the idea that information technology and the information carried on it cannot be carried out until it has been implemented and used (McDonald 1998, pp. 32–33; Lee 1999). The implementers and users of information technology make information systems into support tools for a functioning activity system. The realization of information systems is controlled by people and organizations that implement and use information systems. For this reason, the same information technology can be implemented and used in different way, because there are many factors and processes that impact the continual use of an information system, its management, maintenance and change (Lyytinen 1986; Lee 1999; Davenport 1997; Hyötyläinen 1998; Irani 2002; Al-Mashari 2003).

The change of the focal point in research activity with regard to research objects and research problems, as well as methods, reflects that, concerning the planning, implementation and use of information systems, we have accumulated years and even decades of experience, information and know-how. This can be interpreted, on one hand, as a practical evolutionary development of new methods in the field, and, on the other hand, as an attempt to achieve better certainty in handling practical matters (Lee 1999; Iivari & Lyytinen 1999; cf. Nelson & Winter 1982).

However, the reason why the focal point of research has changed cannot be explained completely by the above interpretation. One can also see this as being a question of a more fundamental change with regard to the research world's conceptual approach methods and changes in them, changes in perspectives (McDonald 1998; O'Donovan & Roode 2002). This is affected partly by the views of what the phenomenon, extent and concepts are with regard to information system applications, as well as what is the essence of research methods focusing on the application of information systems (Lee 1999;

Checkland & Holwell 1998; Iivari & Lyytinen 1999; cf. Easterby-Smith et al. 1991; Ghauri et al. 1995; Laudan 1977). Thus, conceptual models are needed in connection with the information system's planning and implementation processes, as well as for the development dimensions that affect the development of the company's activity system (Avison & Fitzgerald 1999; Earl 1999; Kuutti 1999; cf. McDonald 1998, pp. 49–52). In this regard, we would usually separate two research worlds: positivism and interpretativism, which is close to the hermeneutic approach (see Lee 1999; Easterby-Smith et al. 1991).

From the perspective of posing questions in this study, it is also important to emphasize the conceptual model approach, because concept development is an essential matter for research agendas (Lee 1999; Al-Mashari 2003; Mähring et al. 2004; Hanseth et al. 2004). It is important to emphasize the constructive approach separately. The tradition of action research, as its developed form, represents constructive approaches in applying information systems and using information systems in research and development work (see Lee 1999; Checkland & Holwell 1998). Within the framework of action research, a number of different approach methods have been developed. The research approach of experimental development research has become one constructive research and development approach used in connection with business activities (Toikka et al. 1986 and 1988; Alasoini et al. 1994; Hyötyläinen 1998 and 2000; Hyötyläinen et al. 1997 and 1999; cf. development work research, Engeström 1987 and 1999).

2.2 Research activity and conceptual worlds

In principle, research activity is the same as problem-solving (Laudan 1977), although the function of discovery is also emphasized (Preston 1997, pp. 13–14; Strauss & Corbin 1998, pp. 1–9). For example, study pertaining to information systems and their use can be viewed in essence as building and using information systems. They can also be viewed as problem solutions and methodical development works in regard to the building and use of information systems (Avison & Fitzgerald 1999; Checkland & Holwell 1998; Iivari & Lyytinen 1999; Lee 1999). However, the research work pertaining to information systems faces the same problem as research work in general. Information systems are complicated systems and their planning and use occur within complicated organizations. On a practical level, it is only a question of

complicated strategic issues, technical and economic problems and organizational decisions (Earl 1999; Galliers & Swan 1999). The conceptualization of these issues cannot be done on a practical empirical observation level alone. There are good reasons for stating that empirical observation itself cannot be "freely" made for the needs of research. Within the study, one is forced to view the study subject through a "lens". This lens, i.e., the conceptual world, defines, to a great extent, what issues will be studied and what interpretation will be made within the contextual framework of this conceptual world (Habermas 2003, pp. 33–36; Kuhn 1996; Laudan 1977 and 1996; Preston 1997, pp. 88–98; Psillos 1999, pp. 284–289; Sayer 1992). One can say that the most important function of the theories created within the framework of these worlds is to produce solutions to certain practical and conceptual problems.

There are many conceptual worlds. In this case we will talk about research paradigms. One can segregate among a number of competing paradigms, within the framework of which one can conduct research. Kuhn (1996) states that different scientific paradigms refer to different worlds, and they have, to a great extent, different issues in the focal point of the research. Furthermore, in Kuhn's view, the prevailing "normal" paradigms gradually lose their full power and competing paradigms take center stage. New scientific paradigms are able to take on such research problems, which previous paradigms did not focus on or put less focus on. Laudan (1977) has expressed critical views regarding Kuhn (1996) "revolution theory" against scientific paradigms. Laudan (1977 and 1996) emphasizes the evolutionary development of the scientific tradition, although he does not totally deny the existence of various scientific paradigms and the periodic change in dominant paradigms.

It has usually been noted that the views on research subjects and research problems have an impact on what methods are chosen (see, e.g., Rosenberg 1995; Easterby-Smith et al. 1991; Ghauri et al. 1995). A more fundamental issue is associated with this conceptual worldview on which the reference framework and approach methods are anchored. The dividing line between these world views makes a big difference in the research. The foundational premises being part of these world views outline and define, to a great extent, how the world is understood, and the research and its objects are conceptualized (Easterby-Smith et al. 1991, pp. 22–32; Fay 2003; Lee 1999; Rosenberg, 1995 pp. 10–25; Tsoukas & Hatch 2001; Turner 2003).

This study is focusing on information systems and their application. A special emphasis has been placed on enterprise resource planning systems and their planning and implementation process (see Lyytinen 1986; Whinston & Dologite 1999; Lee 1999). This area has been widely acknowledged as its own research field. The basic issue here is the issue of the application of information systems in organizations and the management of this application process (Checkland & Holwell 1998). In this study, research subjects will be studied within the context of research approach methods and practical development work.

2.3 The world of positivism

Positivism and its world view have had a strong foothold in management studies and social science research (Rosenberg 1995; Turner 2003; von Wright 1971). The model has been a scientific research concept, which includes various hypotheses that are tested by means of different tests. The hypotheses that pass the test will be accepted. They will remain in effect as long as evidence to the contrary challenges them. Positivism represents an empirical approach. Science is considered to be based on direct empirical observations, which, over time, accumulate, become clearer, and expand. Observations, as well as other observation concepts that form their basis, are considered independent of theories and theoretical concepts. Observations are considered to be the foundation on which subsequent theories are based (Kusch 1991; cf. Chalmers 1999). As well, in the study associated with the application of information systems, the positivistic approach has had a central position. This was especially the case earlier – until the first half of the last decade – when a technically oriented approach was dominant. Research was thus based almost exclusively on positivistic starting points (Lee 1999).

Embedded in positivism is a certain worldview. From the perspective of research, the world manifests itself as a set of empirical facts; one could even say free-standing incidents (von Wright 1971; Rosenberg 1995; Easterby-Smith et al. 1991). The purpose of this study is to use operational meters and classifications in “catching” these facts. Factual information that is collected in this way and conclusions drawn from it are used either to prove theories and hypotheses based on it or, contrarily, to refute it, i.e., to falsify it (Popper 2002, pp. 57–73; see Rosenberg 2005, pp. 120–125). By varying the “test settings” as

much as possible, one can increase the reliability of the theory. However, one can use empirical studies to glean results, which form a foundation for new studies. When, a sufficient number of times, one has received the same type of regular confirmation, one can use these generalizations to create a new theory to explain observations and interpretations. The more regularly these general "laws" are observed in various environments, the more general the theory is.

From the perspective of positivism, the actors' motives and intentions will remain outside the explanation models. These are not "accepted" as facts in causal models explaining reality and explaining factors and theories. The model of science is a causal explanatory model. The inclusion of the motives and objectives of the activity or actors, which are the subjects of the study, would make the explanatory model finalistic or teleological, which is against the ideals of positivism (Turner 2003; von Wright 1971 and 1998; Tsoukas & Hatch 2001; see Rosenberg 2005, pp. 56–61). According to positivism, the researcher must be a "cool" outside observer, who does not become involved himself in any way whatsoever in the events that he is observing, and only observes at a "distance" from the subject (Foucault 2003, pp. 131–133; Lee 1999).

The building and application of information systems have primarily been characterized by a functionalistic approach. The subject has been the information systems' hard side, which has meant a focus on the technical planning of systems (Checkland & Holwell 1998). The dominant thinking has been based on the concept of an organizational goal-seeking system. The most important organizational function has been thought to be decision-making and its connection to objectives and goals. The information system's goal has been seen to be the support of this decision-making (cf. March & Simon 1958; Cyert & March 1992). This approach has affected the manner in which research regarding the implementation of an information system has been conceptualized. The basis has been a positivistic approach, where the testing of the hypotheses is the dominant conceptual model (Checkland & Holwell 1998; Lee 1999).

2.4 The world of interpretativism

The positivistic science metaphor has been subject to criticism. The starting point here was the reversal of the order of theory and observation. Theories are

considered as forming the determined foundation. Observations are tied to theory (Kusch 1991; Kuhn 1996; Sayer 1992; cf. Chalmers 1999). Interpretativism represents the tradition of the anti-positivistic model (Fay 2003; von Wright 1971). However, interpretativism consists of a number of scientific layers. It can be said that the roots of interpretativism are partly in hermeneutics and partly in phenomenology, the roots of which are somewhere at the end of the 1800s and the beginning of the 1900s, in the tradition of German philosophy and social science. Hermeneutics and phenomenology were developed in opposition to positivism (von Wright 1971).

The starting point in interpretativism is that research activity is social activity, and, as such, socially constructed (Lee 1999; Berger & Luckman 1966). Research is, by its very nature, individual or group activity, with the objective of building theories. This implies that theories are only viewed as theories. Theories do not exist somewhere "there" in reality, so that they can be found. Rather, the truth is that we invent them, based on our practices and problem-solving activities (Habermas 2003, pp. 22–30).

In addition to the explanation model adopted in the positivistic tradition, an "understanding" approach was presented. The meaning of understanding is that the researcher reconstructs the mental atmosphere, thoughts, sensations and motivations of the actors who are his research subject (could be individuals, groups, organizations or similar agents). This type of understanding is associated with a finalistic or teleological interpretation (Turner 2003; von Wright 1971; Rosenberg 2005, pp. 56–61). This type of understanding means a close connection to semantic and semiotic approaches and methods, which are associated with later constructive approaches (Ricour 2003, pp. 74–96; von Wright 1971; Heiskala 2000). In semiotics, the issue is to describe and conceptualize the meanings that are formed in connection with the communication processes between the actors and within the actor networks. This interactivity consists of structures and relationships within the framework of which the actors are acting and can try to affect the change of these frameworks through their own activities and conscious actions (cf. Giddens 1984).

This takes us to an interesting discussion of the actors' awareness of the basis for their activities, as well as the rationality of the activities. There are at least two views and assumptions in this regard (Lee 1999; Heiskala 2000). On one hand,

there are views that the actors are not exactly aware of their motives and the grounds for their activities. This view is represented by the so-called suspicion's hermeneutics (see Heiskala 2000). Perhaps a more general starting point is the view that people know what they are doing. On the other hand, the view about the rationality concerning activities is a more difficult issue. Many times, human activity seems anything but rational. The hermeneutic understanding approach tries, however, to reach to the roots of this issue. Thus, one needs to consider the entire context and operational environment of the activities. The idea is that the apparently irrational activities by individuals and groups can be considered rational. Individuals and groups can be considered to act in a "rational" manner in a context and environment that is, in itself, irrational. It can also be said, from an individual's perspective, that rational behavior refers to activities that make sense to a person in terms of the goals, desires, and capabilities of that person, based on the prevailing circumstances (Weick 1995; von Wright 1998; Devlin 1997, p. 15; Norros 2004).

In an interpretative world, the researcher, him-/herself, is the instrument of observation. It is believed a researcher participates in the understanding process of the "life world" "(see Habermas 2003, pp. 10–17). Research is an iterative process, where one can encounter interpretive "blocks" and new insights. The starting point is the thought that the researcher is in the center of everything, in the middle of "the world". The foundation is inspective knowing, hence the research subjects cannot be cleanly separated from the knowing party. This is in complete contrast to the positivistic and "perspective" research approach (Lee 1999; von Wright 1971 and 1998).

The hermeneutic research approach includes so-called double hermeneutics. Sciences that study human and group behavior are forced to analyze human everyday life and activities and their manifested significance, and, based on this material, create expert interpretations, which regularly come back to individual, group and organizational everyday concepts, which the acting parties use in their activities (Giddens 1984; Heiskala 2000; cf. pragmatism, according to which activity promotion is the goal, Rescher 2000).

In studies associated with information system application, the interpretative and hermeneutic research approach has started to gain a foothold. During the last decade, there have been many studies based on the spirit of interpretativism (Lee

1999). Separately there has been a so-called "soft system" method developed, which approaches, in a new way, the planning and use of information systems. The starting point is an "understanding" and activity theoretic research analysis framework (Kuutti 1994; Checkland & Holwell 1998; Torvinen 1999; Rose 2002).

2.5 Dilemmas of action research and the constructive approach

In the area between the two above-discussed research worlds and, partly as a counterweight to them, there appeared a so-called critical social theory, beginning in the 1920s and 1930s (Alvesson & Deetz 2000; see Phillips 2000). According to critical theory, it is not enough just to explain and understand the issues. The starting point is the idea that the researcher should not only be an observer, but that he should affect and he/she also be affected by those technological and organizational systems that he is studying. Based on this thought, the researcher's obligation is to criticize "unfair" conditions and to act to change these conditions (Bohman 2003).

To a great extent, one can consider the action research tradition to be close to the central thoughts of the critical theory (Argyris & Schön 1978; Bruce & Wyman 1998; Westbrook 1995). The founding father and central figure in action research is usually thought to be Kurt Lewin, with his research activities (Bruce & Wyman 1998). The beginning of activity research is usually considered to be in the 1930s and 1940s. Kurt Lewin applied the experimental method of natural science to social science by using a change experiment to understand the social problems of his times. Lewin focused his research on group dynamics.

As its most developed forms, action research can be seen as a research method that supports ongoing change processes in the real context of organization. According to this, the central characteristics and properties of action research are usually considered the following "minimum requirements": (1) practical orientation; (2) attempt toward change; (3) the research party's participation in the research and change process (Easterby-Smith et al. 1991, pp. 33–34; Bruce & Wyman 1998, pp. 12–15). In spite of this, within action research there are many types of projects. Applied or developing theories, research subjects and

stated questions can vary significantly in different studies (see Argyris & Schön 1978; Trist 1981; Kuula 1999; Kasvio 1990; Naschold 1994; Bruce & Wyman 1998; Mumford 2001).

Based on the grounds of action research, *constructive approaches* have grown and formed (Hutchel & Molet 1986; Kasanen et al. 1993, Alasoini 1999; Lukka 2000; Heckscher et al. 2003; van Aken 2004). The constructive approach involves the incremental cycle model applied in the development and research process. The same kind of the development cycle is also used in action research studies (Bruce & Wyman 1998, pp. 20–24). At the same time, within the field of constructive approaches, there is ongoing discussion about its "scientific nature". This is based on the fact that constructive research tries, on purpose, to disturb the social reality that it studies. Constructive research has been described as a practical approach that can be adapted to changing situations (Turner 2003). The constructive model has been considered a laborious way to conduct research. The research is usually a long and extensive process, which constantly collects materials from various sources (Alasoini et al. 1994; cf. Engeström 1987).

It has been noted, that, during the constructive research, the designs regarding social reality and the research process change continually. As well, researchers have to adopt two roles in the process (Habermas 2003, pp. 15–17; Lukka 2000; see Engeström 1987 and 1999). On one hand, researchers should be able to view the activity systems, which are studied from a "systemic" perspective, "from without". Researchers construct and create models about the activity systems as if they were looking at them from above. On the other hand, in the intensive stage of the study, the researchers' attention is focused on the change process and, there, primarily on the individuals' and the organizations' problem/solution processes (Hyötyläinen 1998). In the activity systems, researchers must adopt the views of the acting persons and different groups in order to build and develop from the actors' "view", and, based on their interpretations, activity systems. Thus, researchers are actively bound to the activities of the social activity systems, which are the subject of the research. The study of activity systems becomes a part of the activity system historical development phases, present and future modeling and construction, both of which are collective and multi-voiced understanding as well as dialogue processes (Heckscher et al. 2003, pp. 126–127). The researchers are part of the development work and participate

in the planning and implementation processes of new models for the activity systems (van Aken 2004; Hutchel & Molet, 1986; Engeström 1987 and 1999).

This pertains to the basic dilemma of the traditional action research (Argyris & Schön 1978). The ideal in action research is generally to strive for "democratic" and new practices and structures. The issue is what knowledge do researchers need to have and what practices and structures are "democratic"? Through which knowledge do researchers provide recommendations and suggestions to the target individuals in order to resolve issues? The response to this dilemma in action research could be to emphasize participation (Bruce & Wyman 1998). The emphasis has been put on the organization of the development process being the researcher's obligation. The task is to create a development process where everyone has the possibility, on an equal level, to participate in the analysis and processing of the current situation, as well as the planning and implementation of solutions (Schein 1987 and 1999). Thus, the researcher's role is primarily to create an incremental development process and organization.

Instead, in the constructive approach, the view is that the information gained from the constructive research during the development process is used for concrete activities and its analysis for the purpose of concrete activity objectives (van Aken 2004; Hutchel & Molet 1986; see Habermas 2003, pp. 19–22). The information from this is concrete and tied to the operational environment (Glaser & Strauss 1967; Lukka 2000). According to this, the activity options and solution models emerge from the situation's "logic" and from the acting party's views regarding objectives and solutions (Hammersley et al. 2000). Here, a partial factor in the situation can be controlled and one knows how to act in the situation or to affect it to reach the necessary results (cf. pragmatism, James 2004; Rescher 2000).

In the field of the traditional action research, the latter option is considered to be a controversial issue (Argyris & Schön 1978; Bruce & Wyman 1998). Can a researcher participate in formulating the solution and should the researcher bring forth his own opinions about the solution models? Does the researcher therefore employ a consultative approach? Does research thus become expert research (Heckscher et al. 2003, pp. 108–111)? There are no clear answers to these questions. According to the constructive model, this approach is only viable if the researcher bases his views and future visions and solutions for the

organization on thorough theoretical and subject-related analysis (Lukka 2000). The solutions should be made based on the subject's history and the identification of the subject and its environment's inherent possibilities and limitations, as well as on the analysis of the actors' views. Thus, the researcher should adopt a systemic view of the research subject (Hyötyläinen 1998 and 2000, see Engeström 1997 and 1999). In that way, it is possible to bring well-founded views as solutions. However, what remain are the proposed solutions' consequences if the organization adopts the researcher's solution models. For this, the answer is the organizations' activity logic. The organizations do not adopt any kind of solutions. The organizations must be ready to adopt and implement new activity models and make decisions regarding them (Nooteboom 2000, pp. 170–189; see Szulanski 2003). Thus, the organization follows its own evolutionary path-dependent development (Nelson & Winter 1982), which can be facilitated through appropriate intervention (March 1991).

The creation and adoption of new issues and solutions unknown to the organizations cannot be implemented linearly in an organization. The formation of new practices progresses primarily through trial and error. In the beginning, new forms (new concepts, practices, products and technologies) are incomplete and uncertain (Nooteboom 2000). In creating new forms, one will collide with previous practices and their limitations. Through constructive research, the attempt is to start development processes. Through constructive development and research activities, organizations can try new action methods as well as organizational and technological solutions. However, the implementation of solutions and the adoption of these in other parts of the company is another task (Dixon 2000; Nooteboom 2000). Often, solutions require supplemental innovation in the company's other systems. Only after the formation of adequate conditions is it possible to establish new action models within the organization.

2.6 Realist approach and context-dependency of knowledge

The issue on the nature of truth and the knowledge concept in question are closely intertwined. It is a question on which is goal of inquiry, and what is object of inquiry and how it is perceived (Armstrong 1997, pp. 113–138; Schmitt 2004a). In that sense, constructive research can be labeled as "practice

theory" (Stern 2003). That means that the constructive study takes practices as its point of departure, and treats practice as a fundamental category for making constructs in practice, as well as in ensuing theorizing (van Aken 2004; Lukka 2000). A knowledge concept of realist approaches offers a means to conceptualize constructive contribution and its foundations of knowledge (cf. Mizak 2004, pp. 159–168).

In scientific tradition, a so-called realist theory of science and approach has evolved (Bhaskar 1997; Sayer 1992; Archer 1995). According to the realist approach, the world exists irrespective of our knowledge about it, but our knowledge about the world is incorrect and tied to theory. The world is viewed as separated and divided. Causality is seen in realist approaches through multifaceted and multilayered development mechanisms (Sayer 1992, pp. 103–117). The world is not considered to consist of events alone, but also of objects and structures, which have a force and ability to create events (Archer 1995, pp. 195–246; cf. Giddens 1984).

According to the realist approach, the distinction between facts and theory is challenged. It is seen that theory affects observation itself, so that the empirical observation and captured "facts" are said to be "theory-laden" (Preston 1997, pp. 40–45; Sayer 1992, pp. 45–46). So it is question of how we conceptualize phenomena to be studied. As von Wright (1971, p. 1) says: "discovery and description of facts cannot always be conceptually separated from a theory about them and is often an important step towards an understanding of their nature." In addition, knowledge production is seen as social activity. The conditions and social relationships of knowledge production are believed to affect the content of knowledge (cf. Norros 2004). The objects of social scientific research are social communities and organizations and human activities therein. The object is considered to be concept-dependent and socially produced in its character (Sayer 1992, pp. 29–35).

In addition, to a great extent, knowledge is linguistic so that language and the manner in which we communicate are not independent of it, which we know and can communicate (cf. Wittgenstein 1958). According to the realist approach, we need to make a distinction between thought objects and real objects (Sayer 1992, pp. 46–51). We can only think about the real object in terms of a thought object. We cannot obtain outside language of knowledge to see how it compares with

the object (Habermas 2003, pp. 30–36). It is seen that not only theoretical statements but empirical or observational statements are both included within the realm of thought objects. Real objects are facts as things or states of the world. Thought objects attempt to refer to real objects but they are qualitatively different from them. However, it is emphasized that theoretical and factual knowledge has something in common.

This raises the question of objectivity and "truth" of our knowledge. The main argument, according to Sayer (1992), is that practice is a link between knowledge and the world (cf. James 2004). So we should think of knowledge not so much as a representation of the world, but as a means for doing things in it. Besides, social science studies are characterized by the double hermeneutic, which is based on the nature of objects to be studied in social science studies, which include conceptual and concept-dependent phenomena. The objects are social communities and organizations and "communities of practice" (Wenger & Snyder 2000). There is the need for interpenetration of the frames of reference of observer and observed, although the thought object/real object distinction still applies to social science, when properly qualified. It is so that social scientists produce interpretations of objects, but do not generally produce the objects themselves (Sayer 1992).

The realist approach emphasizes the context-dependency of knowledge (Sayer 1992, pp. 12–17). Different knowledge must be applied for different purposes and contexts. The central issue is how to do something in addition to understanding and being able to explain issues and phenomena (von Wright 1998; Norros 2004; cf. pragmatism, Rescher 2000). The starting point is that knowledge is produced and used in two types of contexts. One of these contexts is work, i.e., human activity. The criteria for truthful knowledge are, in reality, practice and human activity (Norros 2004). The other basic context for knowledge is communicative interactivity (Sayer 1992, pp. 17–22). By this is meant all human interactivity, which contains sharing and communicating meanings (Choo 1998; Weick 1995; Wenger & Snyder 2000).

The realist research approach is close to the constructive world view. As far as management studies as well as social scientific research is concerned, the realist approach is clearly distinct from the natural science method. The subject and the object are considered to be closely associated with each other. The researchers

form a social activity and language community, which shares certain social meanings. The research subjects are social communities, which act within their environment, while sharing other social relationships and meanings among them. It is significant that, to a great extent, both communities share the same meanings. It is central that both the research community and the community subject to the research have a relationship to the material world in which is reflected both research knowledge and practical know-how about the community subject to the research. For this reason, regular changes in meanings and practices go hand in hand (Sayer 1992; Rescher 2000).

2.7 Conclusion: a research and develoment model

The starting point in this study is a question of the practical interest in the building of a theory. The basic issue in this study is the relationship between practical development and research. Above in this chapter we have analyzed different scientific research approaches and study models. The main question concerning the analysis is how the real world is viewed and, in particular, how the relationship between research and practical activities is viewed by various scientific approach methods. Based on the analysis, we can produce two research approaches with their study models in which the role of theory is emphasized and practical activity as well as practical development are seen as an essential part of theoretical consideration. These are the constructive model, based on the premises of action research, and the realist approach. In addition, one can interpret that some elements of interpretative approach offer solutions to formulate constructive approaches.

Based on the premises of the constructive and realist approach discussed above, we have defined a research and development model through which it is possible to observe the close interaction between research and the development work in practice. In the model, intervention is labeled as a research-aided development process, which indicates that an organization's development work is supported by research (Alasoini 1999; Fryer & Feather 1994; Lukka 2000; Heckscher et al. 2003). All in all, research-aided development process acts as a bridge between research and practice where by means of development cycle development activities are organized (Hutchell & Molet 1986; Bruce & Wyman 1998, pp. 20–24). In this regard, there is a strong effect from research context, focus and

research objectives. These issues can be viewed through the practical subject. The subject is considered to be the information systems' planning and implementation process in an organization.

Figure 3 contains a research and development model. In the figure, we have delineated the research and development design of research-aided development process. The basic thought is the distinction between research and practice and the explanation of the interaction between them. This diagram illustrates the relationships among research and its concepts models, and practice and its development processes.

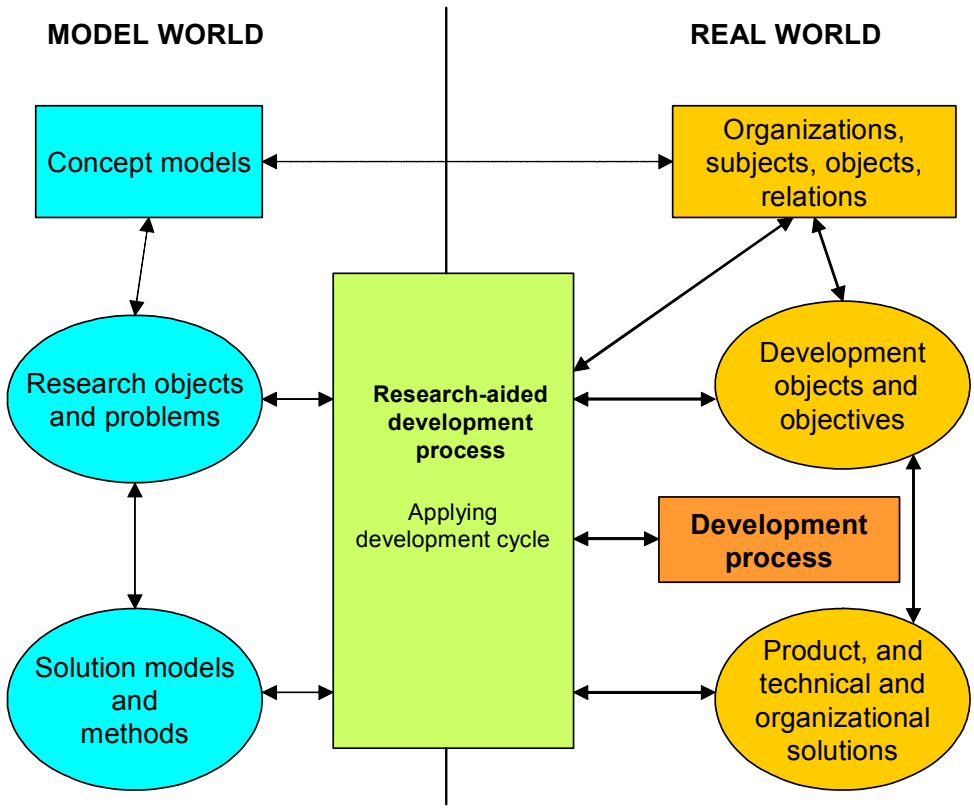

Figure 3. Research and development design of research-aided development process.

In the figure, a distinction is made between the model world and the real world (see Habermas 2003, pp. 15–17; Sayer 1992, pp. 46–51). The *model world* describes imagined and thought subjects, acting parties, and relationships, and the *real world* presents real organizations, subjects, objects, relations, and development processes. Due its nature, the model world is theoretical concept system, however, the model can also be seen include empirical and factual knowledge (Ghauri et al. 1995, pp. 19–23), which, in the figure, is implied by arrows showing connections between the conceptual side and practice, partly going through research-aided development process, which has a near relation to the development process in practice and its definition. This distinction to the model and real worlds is of great importance, because we have no perception without concepts (Rosenberg 2005, pp. 69–111). Moreover, conceptual development and new theories enable us to see new objects or aspects of objects, not only a different interpretation of everyday observation (Sayer 1992, pp. 51–56; cf. Kuhn 1996).

The figure is a principle picture about the development processes within the organization and the way in which we receive information about these processes and the process conceptualization. There are development objects and objectives set in the organizational context in question in which the environment factors and demands concerning an organization may have of great role. As a result, an organization can launch a development process for aiming at planning and implementing new product, technical and organizational solutions (Bruce & Wyman 1998, pp. 20–33). For example, this could be a question of the information system's planning and implementation processes (Checkland & Holwell 1998; Lee 1999).

To start development activities within framework of the study, according to the model in the figure, require "theoretical" models about the organization's development objects, objectives and process, and associated factors. It can be said that the models are the theory-related concept models (Sayer 1992). The models are also needed in connection with the information system's planning and implementation processes, as well as for the development dimensions that affect the development of the company's resource planning (Avison & Fitzgerald 1999; Earl 1999). The model world foundation consists of concept models and their relationships and hierarchies. In connection with the information system's planning and implementation process, the concept models

form group models, which describe the real-world organizations, the actors and objects and their dominant relations. Models also describe the system's planning and implementation processes (Kuutti 1999).

It can be stated that concepts and concept models are the building blocks of the research. By its nature, the concept models are, at the beginning, abstract models and concepts, which describe the real-world subjects, objects and their properties, and their changes (Ghauri et al. 1995, pp. 13–23; Sayer 1992, pp. 56–65). For this reason, it is important to define the dimensions and factors included in the analysis. From the perspective of research and development activity, one must include all factors that are essentially associated with the change.

The focus of the model world is organizational human communities, which communicate through meanings (Baumard 1999; Choo 1998; Weick 1995). The concept models must take this into account. In addition, the organizations and people change their real-life conditions and material circumstances in connection with practical measures (Sayer 1992, pp. 22–29). In this way, the change processes are social processes. As well, in connection with the planning and implementation process of information systems, it is a question of social and technical change process. As a result of planning and implementation, the changing information system becomes a new tool for the organization and the users. The parties acting in the organization can experience the system as a real facilitating work tool. But an information system can become a system that controls activities, which defines what meaning the actors give to their actions. The direction in which one goes within an organization is, to a great extent, dependent upon the organization's planning methods, as well as the dominant action methods within the organization and the personnel's orientation foundation (Lyytinen 1986; Kuutti 1994; Lee 1999; Norros 1991 and 1996; Hyötyläinen 1998 and 2000).

An essential part of the model theory consists of the research objects and the research object definitions. Based on these, it is possible to clarify research problems. The definition of research problems occurs based on the model world concept models and in association with the development process, which is directed toward the real world. The research objects, with their associated research problems, determine the focus of the study (Easterby-Smith et al. 1991; Ghauri et al. 1995). The research objects and research problems are defined in

the framework formed by the theoretical concept models and the organization's development problems. However, the practical implementation of the research requires that the research problems will be broken down into research questions for which answers are being sought through the study. Research questions are issues around which the acquisition of research material is wound (Strauss & Corbin 1998). From this basis, one can analyze, respond to posed research questions and make theoretical generalizations (Eisenhardt 1989; Engeström 1987; Yin 1994).

For example, in the case of information systems, the research problems can pertain to the activity and learning models in regard to the planning, implementation, and use of the information systems, as well as associated methods (Checkland & Holwell 1998; Lee 1999; Preskill & Torres 1999). It is an essential task to develop a concept model framework by which it possible to specify research questions (Lee 1999), such as what are the stages of the planning and implementation process, what are the planning and implementation models and methods that are used, and what are the various actors' roles, tasks and interactions during the information system implementation process?

During the course of the research-aided development process, we affect the development process and the forming solutions (van Aken 2004; Bruce & Wyman 1998, pp. 19–33) and thus we can obtain a true picture of the organization's processes and their development mechanisms (Heckscher et al. 2003, pp. 107–127). The material and knowledge collected this way can be transferred "back" for analysis by means of the model world concept models. The result is a developed and enriched concept model system, "model theory". The thus-formed model theory consists of a theory creation, which is based on concrete context and the analysis of its material (Glaser & Strauss, 1967; Stern 2003; Strauss & Corbin 1998). At the same time, the enriched model system forms the foundation in defining the real-world development objects, objectives and the planning of the solutions (Lukka 2000). The model system is also associated with solution models and methods. They can be seen as describing, on one hand, the research-aided development methods and, on the other hand, the real-world solution possibilities.

The model world and the role of its concept models can be viewed from two perspectives. The concept models, in their first meaning, are "hypotheses"

regarding the development process and its development mechanisms (Eisenhardt 1989; Yin 1994, pp. 20–27). This can pertain to the information system's planning and implementation process and its context. Thus it becomes the foundation of the theory. At the same time, secondly, they create a frame of reference for the research-aided development process, which means using research aids in real organization development processes. The object could be the development of enterprise resource planning and the planning and implementation process of the information system that supports this (Checkland & Holwell 1998; Lee 1999).

In the next chapter, we will discuss the research-aided development model. Special emphasis will be put on the experimental development research and its methods. Here we will analyze the research-aided development cycle and its significance in practical change and development processes, as well as in the development of concept models and theory. Finally, the issues of the results and their interpretation in the connection with research-aided development as well as experimental development research are handled and analyzed.

In the second part of the study, in Chapter 4, we will discuss the information system's planning and implementation process and its development dimensions. This discourse is based, to a great extent, on concept models and analysis of their connections. The main point is of what are the elements of a study model for researching information systems. These elements and dimensions will be analyzed and developed.

3. Research-aided development model

3.1 Research-aided development projects

Research-aided development activity is conducted through development projects in the concrete real settings of organizations. The problem is how the practical working can be connected to conceptual world and to theoretical discussion in the subject area in question, and which relation is between these different "levels" (Van de Ven 2000). In Figure 4, we show the relationship between research-aided development and its connections.

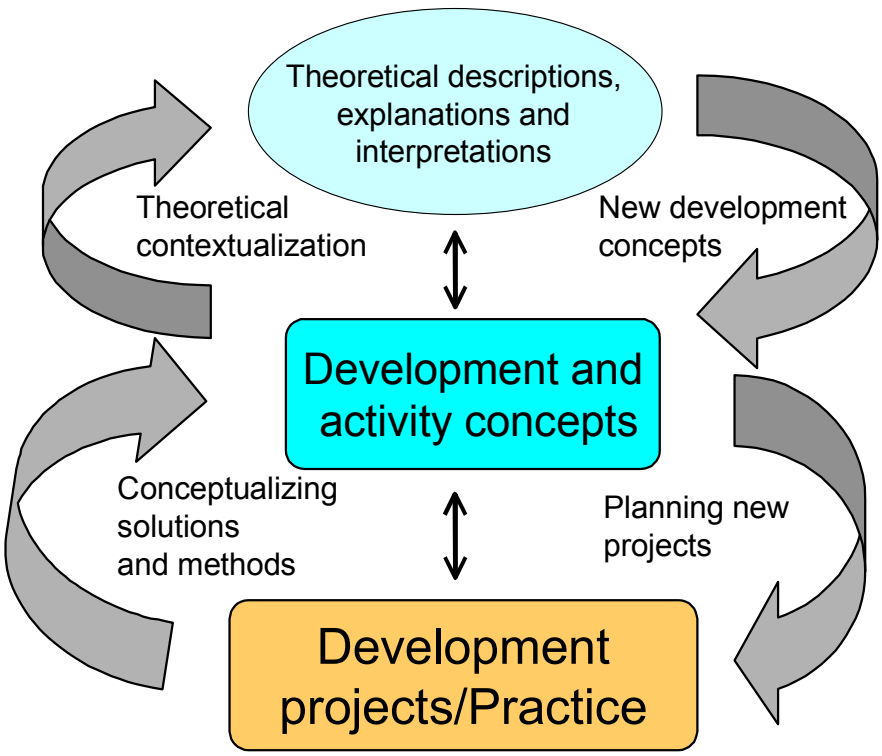

Figure 4. Research-aided development activity and its conceptual levels (adapted according to Tapio Koivisto, VTT Industrial Systems).

The object of research-aided development activity is usually the formation of new practices and their methods in an organizational context. The research context is associated with ongoing functional, productive, technical and strategic

changes (Bruce & Wyman, 1998 pp. 20–31; Heckscher et al. 2003, pp. 107–127). This will form the basis for a development project, where the researchers cooperate with the organization's personnel. The development projects focus on practice, the analysis and solution of development problems.

Based on the results from the development projects and the analysis of the collected material, one will conceptualize the solutions and the methods from which basis one will gain new development concepts and concepts that describe the activities (Ghauri et al. 1995, pp. 13–17). These concepts form the basis for new development projects, which are formulated and initiated.

At the same time, one will use the development concepts and the activity concepts, to conduct a theoretical discussion, by theoretical contextualization of concept models (Sayer 1992, pp. 56–65; Stern 2003). Through the analysis of concepts and the research material, one will attempt to create new knowledge. Through this an effort is made to make theoretical descriptions and explanations, and to present theoretical interpretations. However, the achieved theoretical knowledge aids in the creation of new development concepts and activity concepts. This can be considered the production of new knowledge, which will guide the operations. This could be described as changing practices and disseminating innovation knowledge (Nooteboom 2000; Dixon 2000).

3.2 Experimental development research as a model of research-aided development

We will outline here the concept and methods for doing concrete research through research-aided development process (see Figure 3). We call the developed method as an experimental development research, where one emphasizes the incremental progress of development work, cooperation, and the use of tools (Toikka et al. 1988; Alasoini et al. 1994; Hyötyläinen 1998 and 2000; Norros et al. 1988; see also Engeström 1987 and 1999).

Experimental development research, by its nature, is implemented as case studies (Strauss & Corbin 1998; Yin 1994; Leonard-Barton 1990). In the research, one analyzes complicated activity system development processes in real production life and in their true context. In the study, one studies the

development of activity systems as a social process. The change processes are considered to be implemented as activity and as concretely implemented by the various actors (Burgoyne 1994; Kanter 1983).

Experimental development research is congruent with the focus organization's change process. In Figure 5, we show the "theoretical" development cycle of experimental development research (cf. Bruce & Wyman 1998, pp. 20–24; Engeström 1987, pp. 321–337; Hutchel & Molet 1986; Lukka 2000). In concrete research, the development cycle can take on many different shapes and carry different weight depending on the focus organization's development setup (see Alasoini et al. 1994; Heckscher et al. 2003, pp. 107–142; Hyötyläinen 1998 and 2000).

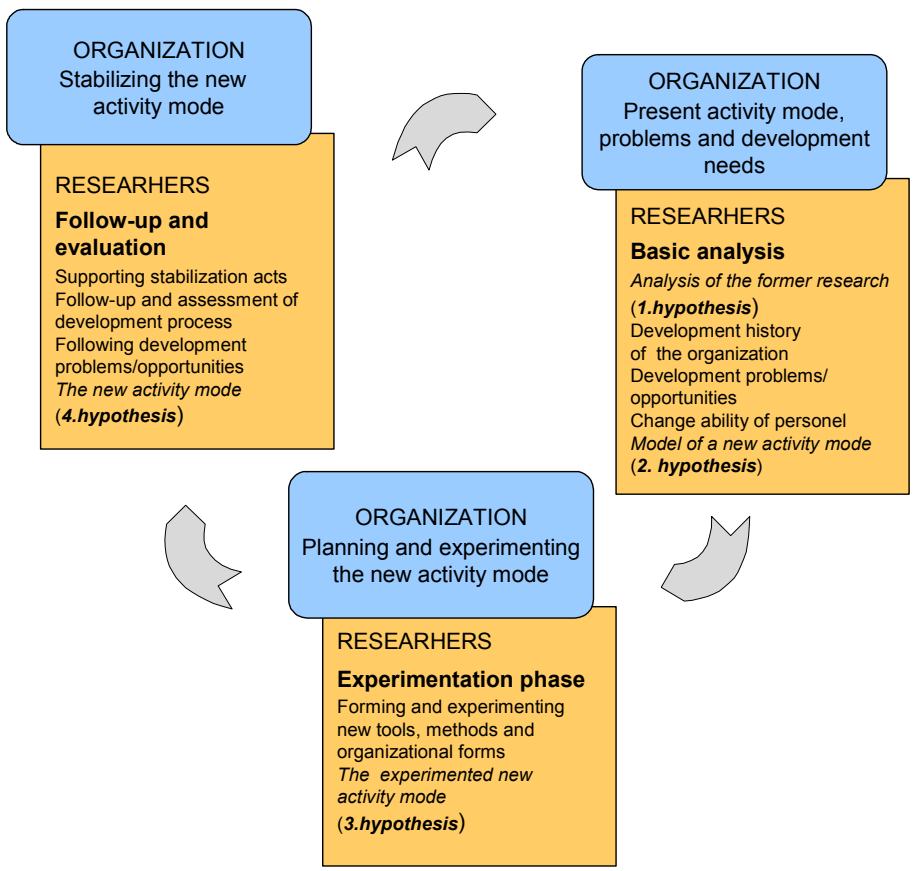

Figure 5. Development cycle of experimental development research.

From the perspective of the organization's development process, one can see three different primary stages. The first stage is the charting of the current activity mode and its problems and development needs. The second stage is planning and testing the new activity mode and its methods. The objective is to reach the third stage, where the new activity mode and its methods are applied and stabilized (Bruce & Wyman 1998, pp. 20–24; Nooteboom 2000, pp. 170–189).

Attempts are made to tie research and development activity as closely as possible to the organization's historical development, as well as to current state and its problems and development possibilities (Bruce & Wyman 1998, pp. 20–24; Engeström 1987, pp. 321–337; Lukka 2000). From the organization and its personnel, researchers form a cooperative project, where the starting point is the company's problems and development needs. The concrete objectives are the absolute requirement for successful development work. Otherwise, it may happen that the personnel commitment remains weak, and the development actions do not receive sufficient support within the organization and its actors, because the solutions, problems, and development possibilities remain too far apart (Heckscher et al. 2003, pp. 107–127; Schein 1999, pp. 94–98; Edmondson & Moingeon 1999).

Joint projects will be based on network cooperation (Lukka 2000). This means that the different functions and the personnel involved will participate jointly in the decision-making regarding the change process. Wide participation is the prerequisite for both sufficient expertise, as well as commitment. Only in discussions among the various parties in a company, and with their cooperation, is it possible to consider various aspects and activity dimensions. Network cooperation is the starting point and foundation of new innovative solutions. Network cooperation can be seen as supporting the creation of learning organizations and knowledge-creating structures (Dixon 1999; Garvin 1993; Nonaka 1991).

Successful development work requires the use of systematic methods and tools in the development work (Engeström 1994; Alasoini et al. 1994; Hyötyläinen 1998). By systematic methods we mean the organization of the development work and cooperation forms through which we support the joint handling of even difficult development measures. By systematic tools, we mean models that can be used to describe complicated entities and planning of objectives together

with the personnel. However, there are models that describe organization structure and activities. One can talk about "theory models", which are customized to correspond to the target organization's special characteristics and needs. There are also different process diagrams, tables and other tools by means of which one can jointly consider matters and transfer methods systematically and uniformly within a company.

The principle is the transfer of the activity mode and methods, which have been created in the planning and testing stage, to normal use (Hutchel & Molet 1986; Lukka 2000). During the first stage, the suitability of the tools is tested on a pilot basis. Later their development will become part of the continual development work. As the volume of processed information and the degree of complexity increase, memory-based and random action methods are no longer sufficient for handling issues. In addition, collaboration requires that the tools used be uniform and transferable. The action methods and tools form uniform rules and a language through which information transfer and cooperation can be implemented (Engeström 1994; Dixon 2000).

Within experimental development research, the analysis and development of solution models occurs in the form of *clarifying hypotheses*, which is used in a research tool in processing research material and case study research results, as well as, when coming to theoretical conclusions (Engeström 1987, pp. 321–337; Lukka 2000; Stern 2003; Yin 1994, pp. 20–27). The *first hypothesis* is based on earlier research and its analysis. In this, research done within experimental developmental research plays a central role, as does the experience garnered from it (see Alasoini et al. 1994; Hyötyläinen 1998 and 2000). In connection with the basic analysis, we analyze the organization's development history, as well as development problems and development possibilities. The analysis of the personnel's readiness for change is essential for delineation of solution models (Heckscher et al. 2003, pp. 113–123; Schein, 1999, pp. 64–83). The result of the basic analysis is a model of the new activity mode and a procedure about how to proceed. At this stage, the model of a new activity mode can be considered to be the *second hypothesis*, from the perspective of the research (Bruce & Wyman 1998, pp. 112–143).

From the perspective of the research, the planning of the new activity mode and its testing can be considered a new stage, experimentation stage. The starting

point is the formation and testing of new tools, methods and organizational forms within the organization. The experimental stage forms the main phase of the research in which new structures and methods are created, tested and developed in the participating organizations (Bruce & Wyman 1998, pp. 168–188; Engeström 1997, pp. 321–337; Hutchel & Molet 1986; Kasanen et al. 1993; Lukka 2000). This phase is critical for the success of the study, and demands creative and heuristic approaches from the personnel of the organization, as well as from the researchers (van Aken 2004). It is necessary that there is a tight co-operative team-work inside the project in which the knowledge of practical and theoretical origin should be combined. In addition, the task of the research is to describe the change context and the change process as well as to evaluate the change and its possibilities of success. The new activity mode, which is formed as a result of the planning and test stage, can be considered the *third hypothesis* from the perspective of the research (Bruce & Wyman 1998, pp. 189–218).

After the organization has transferred to new activity modes and has had the new activity models stabilized, the research will play a supporting role (Bruce & Wyman 1998, pp. 219–238; Hutchel & Molet 1986; Lukka 2000). From the perspective of the study, it is essential that the development processes are monitored and evaluated, which forms follow-up and evaluation stage. From this basis, one can also delineate the organization's next development problems and next development possibilities. From the perspective of the research, the activity mode and methods that are formed in this manner can be considered the *fourth hypothesis* (Bruce & Wyman 1998, pp. 239–257; Hutchel & Molet 1986).

It can be seen, that the series of the clarifying hypotheses formed in the different phases of the study, will form the system of concept models, which already, as such, is the basis for theoretical considerations. The case study results will be analyzed through the model system, which makes possible theoretical conclusions and to reflect the analysis to the literature in the domain through which theoretical contribution will be drawn (Eisenhardt 1989; Lukka 2000; Yin 1994).

3.3 Research results and interpretation

However, there are some problems concerning the results of research-aided development research as well as experimental development research and their

interpretation. These problems can be approached through considering the objective of the research and the context of development work. The further problems posed, concern objectivity of knowledge and the generalizability of the results in the case of case studies (Hammersley et al. 2000; Kasanen et al. 1993; Lincoln & Guba 2000).

The central objective in research-aided development research as well as experimental development research is the development of the activity system and its functions within the focus organization. During the process of research-aided research, one collects information, both about the activity system's structure and functions, as well as its change process (Lukka 2000). All in all, the research-aided development research can be considered as research strategy by means of which we answer the questions how and why (Yin 1994, pp. 3–9). How refers to how practical solutions are created and are made functional. Why refers to conceptual and theoretical questions. Answering these questions requires that one follows the change and development process over a long period of time in order to obtain a comprehensive and dynamic picture of the processes and their properties, as well as the events (Pettigrew 1990). In research-aided development, researchers use intervention in the activity system development processes (Fryer & Feather 1994). The information regarding the activity system structure, functions and change can be used for research purposes.

In the regard of the research-aided development study, we can distinguish among three ways to interpret research results (Easterby-Smith et al. 1991; Hamel et al. 1993; Heckscher et al. 2003, pp. 107–142; Lukka 2000; Yin 1994):

1. To describe the activity system, its context, and changes on which the research and development work has been focused. The purpose can also be to analyze the research and development work object if the research phenomenon is vague and if there is little previous theoretical and research information.
2. To describe intervention, its methods and its progress toward the objectives.
3. To understand the activity system functions and development, as well as, the development mechanisms. In particular, this means the description and analysis of the activity models and the development process. An

understanding and interpretation can be extended to the analysis of the actors' activities and the meanings that are created during this process.

Normally, it is supposed that the definite goal of science is explanation (see von Wright 1971; Rosenberg 2005, pp. 25–37). In the case of research-aided developmental studies, I suppose that it is only realistic to speak about interpretation. A central research objective can be seen to understand and interpret the complicated development mechanisms and the impacting relationships of the activity system's change and development processes. From this base, one can reach interpretation, which can be taken as the form of interpretation models (Glaser & Strauss 1967; Hartley 1994). I supposed that genuine causal models and causal explanation based on them are not in the reach of research-aided development research as well as experimental development research based neither on case studies nor even on social studies in general. Explanation models can be at best finalist (teleological) ones, instead of the type of prediction models (Turner 2003; von Wright 1971). As von Wright (1971, p. 16) states properly, that teleological explanation can be divided into two views: "One domain is the notions of function, purpose (fullness) and "organic wholes" ("systems"). The other is that of aiming and intentionality." I agree that these points are well suited to describe the interpretation and explanation of the results of research-aided development studies.

This type of research approach, oriented toward development, sheds new light on the objectivity of traditional research (Kasanen et al. 1993). Traditionally, research activities in the management studies and social sciences have been focused on acquiring data regarding changes within organizations using various "external" methods, which can be considered to be based on the empirical approach (Preston 1997, pp. 30–32). Thus, the real development process remains outside the reach of observations and generalizations based on them (Pettigrew 1990). It can be claimed that the objectivity of a development research approach is primarily based on the ability of research to disclose the research subject's development mechanisms by means of which one can solve development-limiting problems and conflicts (van Aken 1994; Hutchel & Molet 1996; Lukka 2000; Sayer 1992). A development research approach requires that one changes reality to a "laboratory" where one can develop and test new solutions and their feasibility in a real operational environment (Leonard-Barton 1992; Alasoini et al. 1994). The new solutions found through experiments can gradually be

changed into new dominant practices if they are found to be functional and are accepted within the organization (Bruce & Wyman 1998, pp. 219–238; Dixon 1999 and 2000; Leonard 1995).

The generalizability of the results in case studies is set in question. To this question, I raise some answers. The first is the handling of hypotheses. The hypotheses are distilled during the course of research when the change innovation process is viewed from new aspects by using the research material. During this process, the hypotheses are enriched and become more concrete through which the research produces new knowledge regarding the target organization's activities and activity models. Theoretical hypotheses play a central role in analyzing the results from the case study and "analytical generalization" (Yin 1994, pp. 30–38) and the building theories based on a case approach (Eisenhardt 1989). The second point is the "testable" nature of the results. During the course of the research and development work, the results that are produced will immediately be tested practically, because researchers actively participate in the change processes taking place in the organizations, and initiate, direct and maintain these processes together with the personnel of the organizations (van Aken 2004; Lukka 2000; Stake 1978). The third point is the building of the grounded theory (Glaser & Strauss 1967; Strauss & Corbin 1998). In this approach, theory is derived from data, systematically gathered and analyzed through the research process. Researchers in this field suggest that theory derived from data is more likely to resemble "reality" than theory derived by combining a series of "normative" concepts and suppositions.

In the light of the points presented above, the question of generalizability becomes blurred to a certain extent. We can dispute the ordinary statistical way of studying relationships by correlations based on the sample, which is presented as an example of causal explanation, aiming at referring to how the causal structures are working in the world (Foucault 2003, p. 137; Psillos 1999, pp. 281–289; Turner 2003; von Wrigth 1971). In contrast, through analytical "induction" and generalization (Hammersley et al. 2000; Robinson 1951; Yin 1994, pp. 30–38), based on case study results, we can conceptualize theoretical interpretations, which increase our understanding on the subject domain under the consideration, as well as on the development dynamic of the change process.

PART II: STUDY MODELS OF THE IMPLEMENTATION OF INFORMATION SYSTEMS

In this study, a *practical subject* is the implementation of information systems within the organization. In the study, the object is the planning and implementation process of information systems, which is viewed from research and information acquisition methodological perspectives.

During the past few years, development of information systems has been rapid, as information technology and telecommunications technology has developed. At the same time, the business's needs and expectations in regard to information systems have changed. Companies have changed their activity structures and ways of doing business. Companies have adopted methods based on activity process and team thinking (Alasoini et al. 1994; Ashkenas et al. 1995; Simons & Hyötyläinen, 1995a, b; Simons et al. 1998; Hyötyläinen & Simons 1998; Hyötyläinen 2000). At the same time, the operational environment of businesses has been in flux, which requires, on one hand, an ability for the companies to adapt, and, on the other hand, the use of new possibilities opened by the change. As a result of the development of information systems and the change in company needs, large information system entities have been formed, into which have been integrated numerous applications needed and used by companies. Enterprise resource planning systems represent this type of entity (Kettunen & Simons 2001; Simons & Hyötyläinen 2001).

The planning and implementation process of enterprise resource planning systems is an interesting research subject. Due to its multi-faceted nature, the planning and implementation process is a challenging endeavor for researchers (Al-Mashari 2003). In the field of research, phenomena must be analyzed using *concepts and concept models*. The research approach, and the methods used, define how one obtains information regarding practical development and change processes (Sayer 1992; Heckscher et al. 2003). The research-aided development process provides an active way to approach the planning and implementation process. In the research-aided approach, we are part of the real life change processes and we support the creation and formation of new solutions.

In the second part of this study, Chapter 4, we will analyze the research and development models pertaining to the planning and implementation processes of the enterprise resource planning systems. We will analyze the planning and implementation process of enterprise resource planning systems by means of concept models. Through concept models, we will analyze the implementation process and its development dimensions. The main task is to analyze the dimensions of a study model for development and researching of information systems.

4. Research and application models of information systems

4.1 Research needs and study model

In this study, the application of information systems is viewed from the methodological aspects of development, and research and information acquisition (Lee 1999; Al-Mashari 2003). The main question in this study, in that case, is how do we gather information about planning and implementation processes, and what kind of research models and methods do we have at our disposal for information acquisition and for formulating new concepts and conceptual knowledge?

It is a question on which are the basic elements for doing research on the planning and implementation of information systems. Lee (1999) sees that two different questions are essential to answer to. The first one *is what are information systems*? In this study, in this respect, there are two questions. Firstly, what kind phenomena pertain to the application of information systems in an organization. Secondly, which planning models can be used to support the learning and innovation processes that occur in connection with the planning, implementation and use of information systems. The second question, posed by Lee (1999), is *what is research*? According to Lee (1999), there is also a historical dimension concerning these questions and how we are seeking solutions for these issues (see Iivari & Lyytinen 1999). According to this, one can ask what forms researching information systems currently take. In addition, one can ask what forms researching information systems should take in the future.

It is largely acknowledged that the implementation of an information system in an organization is a complicated process, which involves issues involving technical and organizational changes (Davenport 1997; Feeney & Willcocks 1999; Mumford 1999; Hong & Kim, 2002; Doherty et al. 2003; see March & Simon 1958; Burns & Stalker 1994). From the viewpoint of successful change, technical change should be seen as a fairly large technical and organizational change process (Checkland & Holwell 1998; Al-Mashari & Al-Midimigh 2003). Finally, the nature of the change should be viewed as an organizational

development process (Hyötyläinen 1998; Vicente 1999, pp. 109–136; Norros 2003; Bai & Lee 2003). Organizational factors can become obstacles to successful implementation and, thus, endanger achieving set objectives.

Due to that, when creating a model for researching information systems, it is also essential to take into account the concept of organization. Lee (1999) also emphasizes that information system involves the information technology and the organization. He sees that an information system and its organizational context each have transformational effects on the other. In fact, Lee (1999) emphasizes that information system does not just involve information technology, but also its instantiation.

In Figure 6, we present a model for researching information systems.

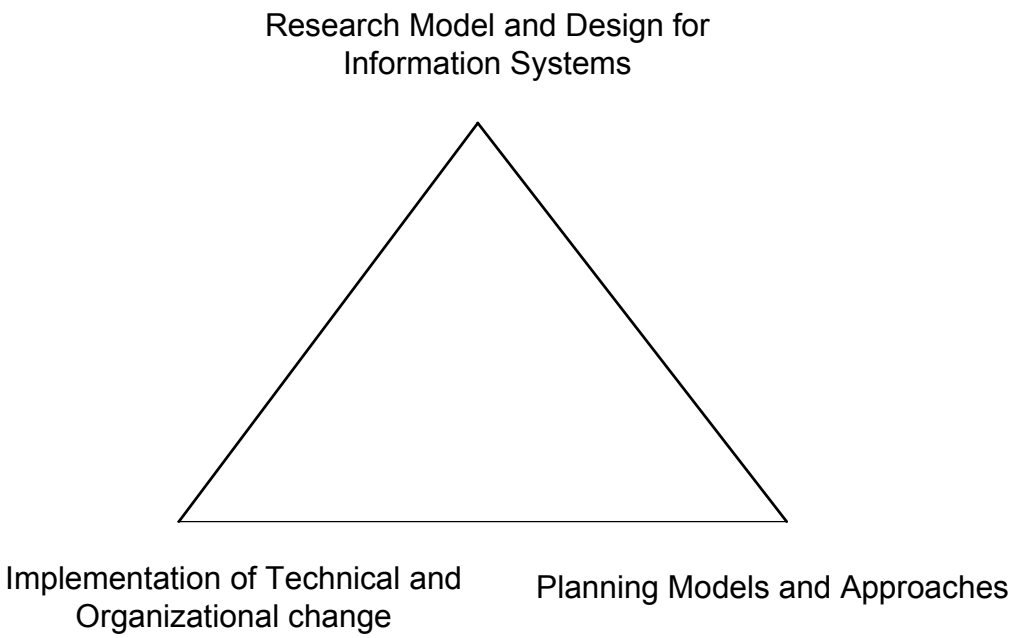

Figure 6. A model for researching information systems.

According to the model, there are three corners of the triangle that determine a research context for researching information systems. First, the model requires the determination of the nature of the implementation of technical and organizational change in the case of information systems. Second, the defining

of planning models through which an information system is planned forms most important factor for evaluating and researching the information system. Thirdly, there are different research models, which also have implications for research design. The main viewpoint in this study is the application of the constructive approach as research method (Lukka 2000; van Aken 2004).

In the following, these three corners of the researching triangle are handled and analyzed. In chapters 4.2 and 4.3, the phenomena concerning the application of an information system in an organization will be analyzed. In Chapter 4.2, the implementation of technical and organizational change is scrutinized. As a result, an interaction and learning model will be developed. In Chapter 4.3, planning models and approaches with regard the information systems will be analyzed, and a new model, a use-oriented planning model, will be developed. Based on these models, in Chapter 4.4, a hypothetical model for researching information systems will be constructed and analyzed.

4.2 The implementation of technical and organizational change

4.2.1 Organizational context model for implementation

In the research and development model shown in Figure 3, the distinction between the model world and the real world has been made. The central concepts in the model world are concept models and their relationships. The central purpose of the model world and its concepts and terms, is, by definition, to emphasize such factors, which, based on the selected research approach method, are able to discern the object's essential characteristics and relationships, as well as the activity and development mechanisms (Laudan 1977; Sayer 1992). The object in this study is the enterprise resource planning system's planning and implementation process and its context. Figure 7 shows a model, which can be called an *organizational context model* for implementation of an enterprise resource planning system. The purpose of the model is to analyze the central variables in the development of enterprise resource planning and the implementation of the enterprise resource planning systems, as well as the links between these factors.

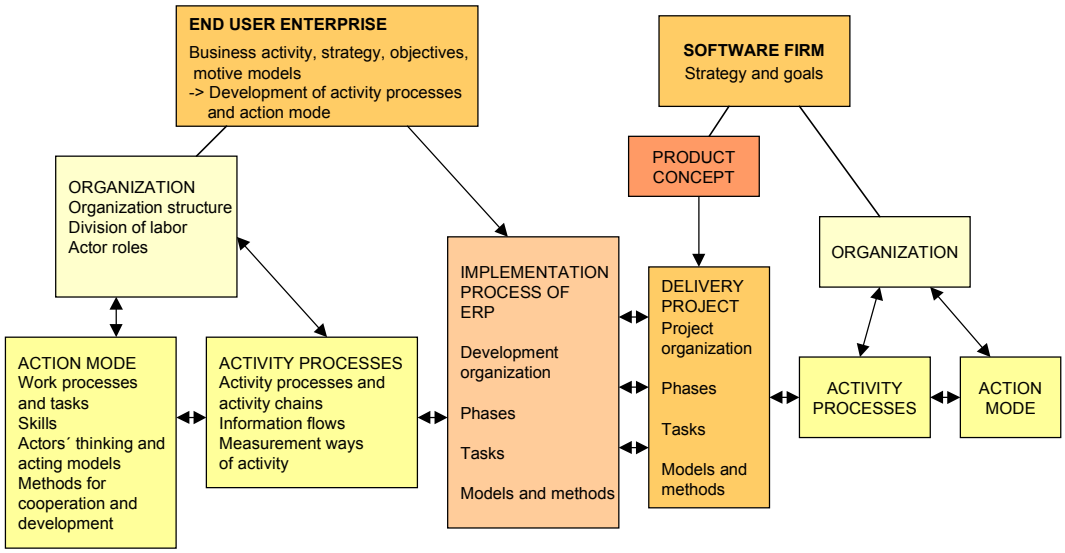

Figure 7. Organizational context model of the implementation of enterprise resource planning system.

As is shown in the model and from the perspective of the ERP system, the central actors are the end-user companies, which develop their activity processes and implement the system. Another possible actor is the supplier who possibly develops the system, which it delivers to the end-user enterprise.

In the model, it has been stated that the implementation of the enterprise resource planning system does not pertain only to ***activity processes and activity chains****, as well as to information flows and activity measurement methods* (Davenport 1993), which are tightly connected to enterprise resource planning of the end user company, but implementation is related in many ways to the enterprise's strategy and action mode, as well as organization (Earl 1999; Bai & Lee 2003; Gottschalk 1999).

A common approach is to go straight to the analysis of the activity processes and procedures of the enterprise resource planning, and to the requirement definitions that are based on this foundation. In other words, one must start the enterprise resource planning system's implementation process (Davenport 1993; Cassidy 1998). However, enterprise resource planning is not a separate process within the organization. Development of enterprise resource planning is linked

completely to the business's activity system and the organization and their characteristics.

In developing enterprise resource planning, one must consider changing the activity processes and activity chains, and action mode and work practices. Basically, the development of enterprise resource planning pertains to all of ***the company's business activities*** (Earl 1999; Farbey et al. 1999; Galliers & Swan 1999; Gottschalk 1999; Ho et al. 2004). The starting point could be the fact that the basis for the enterprise resource planning system's implementation consists of the *strategic thoughts* of the end-user company, the *objectives* set for the change, as well as the *motives* for developing enterprise resource planning. Thus, the development of enterprise resource planning is closely associated with the level of the company's business activities. Naturally, the context for the evaluation of the development needs is formed by the end-user company's line of business, and the company's history and stage of development (Womack & Jones 1990; MacGahan 2004).

Enterprise resource planning and its development has a direct connection to ***the organization and organizational models*** (Hong & Kim 2002; Bai & Lee 2003; Doherty et al. 2003). Organization is defined by its *organizational structure and work distribution*. An organization, for its part, consists of actors, who can be described using their own models (Norros 1991 and 1996). In an organization there are many *actor roles*. An organization has many functions, groups and interest parties (Engeström 1987 and 1999; Blackler 1993; Kanter 1983). Roles and functional models and their analysis are an essential part of the development work of enterprise resource planning (Torvinen 1999).

The development of enterprise resource planning requires organizational change and the adaptation of *team-related and network-related structures*. It is not enough to just make the separate functions more efficient. The need for cooperative work is emphasized even more in activity processes and actor networks, which implement these and where said processes are crossing the functional lines (Womack et al. 1990; Womack & Jones 1994; Cole 1989 and 1994; Ashkenas et al. 1995; Imai 1997; Davenport 1997; Fujimoto 1998; Kuutti 1999; Hyötyläinen & Simons 1998; Simons et al. 1998).

The enterprise resource system has a straight link to ***the action mode*** (Feeney & Willcocks 1999). As the basis there are *work processes and tasks*, with *skills bases*, and prevailing *ways of co-operation.* Since an activity consists of different functions, and groups and individuals operating within those functions. For this reason, different views and assumptions about activity and its development co-exist in the organization. Due to the nature of the activity system, the system includes participants representing many different backgrounds, interests and perspectives. In one sense, organization is *a multivoiced activity system* in which employees and also different functions can be seen to have different kinds of views, which reflect the objectives and circumstances of each actor and function (Weick 1995; Kanter 1983; Vygotsky 1978; Engeström 1987).

These views can be considered with actors' model of thinking and acting. By this way, different kinds of descriptions of *work orientations* prevalent in the organization can be distinguished (Norros 1991 and 2004). These help us understand the permanent modes of thinking, shaped by the history of the organization and its activity, which are the bases of the actors' activity (Engeström 1987, Alasoini et al. 1994; Hyötyläinen 2000). Work orientation can be seen to represent the historical "stratification" implicit in the organization's activity, which is an important form of multivoicedness. Multivoicedness in an organization can be seen to mean the risk of fragmentarization on one hand and the possibility for dialogue that creates new combinations on the other hand (Dixon 1999 and 2000; Isaacs 1999). The natural multivoicedness of the activity system is not limited to views and models of thinking. Work performances can also be seen to incorporate qualitatively different methods and habits of working and operating (Norros 1996 and 2004).

Thus, the formation of new activity models and methods is a laborious process, which, in the organization, lives on as materials from previous development stages in layers in the organizational practices and in the actors' thinking and activity models (Engeström 1987 and 1999). The formation of new activity methods, can only occur as a social process, where the various actors in the organization and the functions reflect and model the operations and affect jointly and separately, by concrete means, the change processes (Schön 1983; Burgoyne 1994; March & Simon 1958; Sitkin 1996; Räsänen 1986; Hyötyläinen 1998 and 2000). In this context, the *cooperation and development work methods* have

significant meaning (Simons & Hyötyläinen 1998; Engeström 1994; Sproull & Kiesler 1991).

4.2.1.1 Implementation and delivery project

In the actual implementation project of the enterprise resource planning system, one can separate a few central factors (see Figure 7). Within the end-user enterprise, these are *the development organization, the process stages and the associated tasks* (Checkland & Holwell 1998; Hyötyläinen 1988). In the process we use different *models and methods* to aid in analyzing our development work and in the planning as well as the presentation of solutions (Hyötyläinen 1998; Rossi 1998; Torvinen 1999).

As far as *the system supplier* is concerned, one must analyze objects and relationships similar to those for the end user enterprise. However, there are differences because of the differences in activities. A supplier has his own strategies and objectives in regard to the customer base and the product. In the supplier's actions, the product concept has a central position (Boehm & Port 1999; cf. Clark & Fujimoto 1991).

A delivery project connects the supplier to the development project of the end user's enterprise resource planning (Hyötyläinen 1998; Simons & Hyötyläinen 2001). The supplier has his own way of forming the *project organization*, phasing the delivery project and dividing it into *tasks*. The supplier also has his own *models and methods*, which he uses to analyze the customer's enterprise resource planning and in building a system, as well as in delivering the system.

In order to understand the supplier's activities, it is important to model, in addition to the supplier's *product concepts, the activity processes, the organization and the action mode*, which are closely associated with the supplier's way of doing a delivery project (Clark & Fujimoto 1991; Wang & Tai 2003). In the supplier's actions, one must also distinguish between organization and activity mode models. These can have an effect on the handling of the delivery projects and the development of the product concepts. In any case, these are important factors in viewing the supplier's activity and learning processes.

4.2.2 A Phase model of implementation

The system's implementation process can be viewed as phases consisting of different stages or cycles (Fichman & Moses 1999; Hyötyläinen 1998; Simons & Hyötyläinen 2001). As concerns the end-user enterprise or a similar organization, the formal phase model for the information system's implementation can be considered to cover cycles from the company's strategic planning to the continual development of the information system and its use (Cassidy 1998, Laudon & Laudon 2000). In the phase model, one can view four different cycles, which can be further divided into more detailed levels. In Figure 8, we see the phase model for the end-user enterprise.

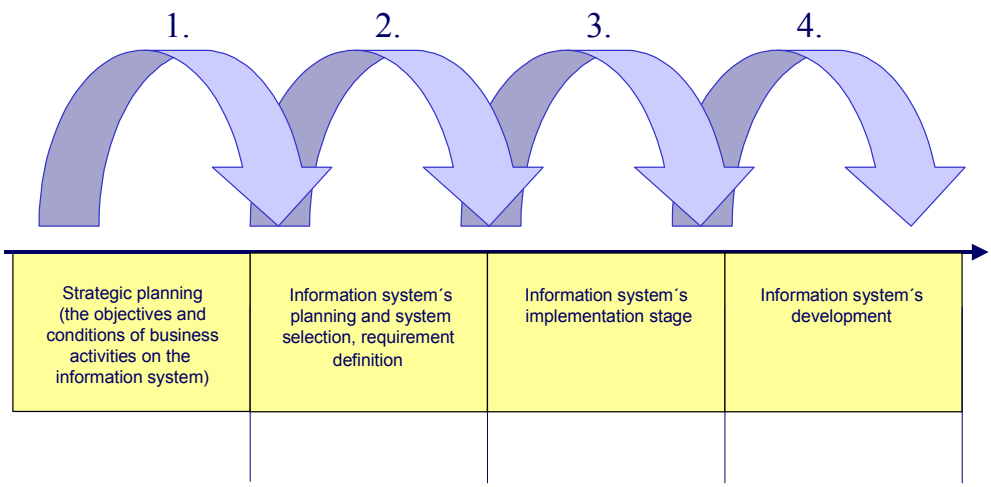

Figure 8. The information system's implementation process phase model for the end-user enterprise or a similar organization (Kettunen & Simons 2001; Simons & Hyötyläinen 2001).

Strategic planning can be considered to be the foundation of a company's business activities (Mintzberg 1994). Strategic planning forms the first cycle in the phase model. As far as strategy is concerned, one can differentiate between actual *business activity strategy and information technology strategy*, where one clarifies the role of the company's information technology in the company strategy and one sets goals for the use of information technology (Mintzberg 1994; Earl 1999; Amoako-Gyampah & Salam 2004). Creation and implementation of a strategy has been thought to be one of business

management's central methods in conducting business and integrating daily activities as part of the company's general objectives and strategic profiling. The acquisition of an ERP system requires significant strategic clarification and consideration of strategic objectives (Cassidy 1998; Sarker & Lee 2002). The lifespan of ERP systems is usually fairly long, the reason for which systematic strategic planning and the consideration of strategic perspectives are essential factors, which enable the selection of an ERP system that supports the business objectives.

The planning of the ERP system project and the selection of the system, as well as the requirement definitions, will come during the later stages of the strategic planning. These measures form the second cycle of the phase model. These measures can be considered to be preplanning for the actual implementation. Central measures in the second cycle of the phase model are the requirement definitions, based on business activities and their development, for the system to be selected, the negotiations and bid request round with the software suppliers/the system integrators, and the actual selection of the system itself. The company's or organization's requirement definitions form the basis for the selection of the system. By means of a thorough requirement definition, which considers different functions and processes, one can ensure that one reaches the required final result (Browne & Ramesh 2002; Kauppinen et al. 2004). Solid requirement definitions also help the company and the suppliers conduct discussions and understand each other.

By the deployment of an ERP system, we mean the implementation, parameterization of the selected system and a possible data conversion from the old system to a new one (Simons & Hyötyläinen 2001; Boehm & Port 1999; Curtis 1998). This forms the third cycle of the phase model. The implementation stage also includes any customization, training, and possible test runs of the ERP system. From a practical standpoint, it is important to have the entire organization, including personnel, participate, which will facilitate the implementation (Bai & Lee 2003; Doherty et al. 2003; Amoako-Gyampah & Salam 2004). The implementation stage also includes the system's introduction into production use, which again means planning and control of the activities using the new ERP system. Starting up production use is often a critical stage in system projects, and requires much effort from the organization and the software suppliers to make it smooth and painless (Hyötyläinen 1998).

The continual development of the ERP system can be thought to consist of maintaining and developing the readiness of the IT factors, both from an IT and business perspective. This forms the fourth stage of the phase model. Continuous development can also include the development of the competence of the company or organization's personnel (Pahl 2004; Leem & Kim 2004). The continuous development of the ERP system means new system updates, as well as increasing the scope of the system used. In addition to the system, the enterprise or organization may develop its own activity processes, as well as the company's enterprise resource planning, which means that the existing system can be used more efficiently. Continuous development can also be considered to be part of the company's normal system development and as continuous operational improvement (Hyötyläinen 1998; Imai 1986 and 1997; Felman 2000).

4.2.3 A Process model of implementation

The phase model presented above describes the implentation as a relatively linear process. As the organizational context model already implies, there are many dimensions pertaining the implementation of the information system. However, the planning and implementation process of information systems can be considered a multistage and complicated process, which does not proceed linearly from objectives to implementation and normal use (Van de Ven 1986; MacDonald 1998; Fichman & Moses 1999; Marchand et al. 2001, pp. 134–144). In Figure 9, we present, in principle, a process model for the implementation process of a technical system (Hyötyläinen 1998).

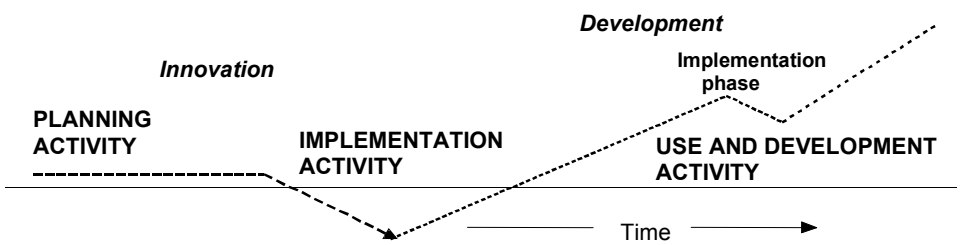

Figure 9. A process model of the implementation of a technical system (time, x-axis, describes time horizon, y-axis describes the output and results of the implementation efforts.

It is usually thought that technical development occurs in innovative jumps from one level to another. This can be considered an ideal model for technical change, but it has proven to be an unrealistic model (Fichman & Moses 1999; MacDonald 1998, pp. 52–54). Instead, there is a model according to which technological jumps quickly begin to "disintegrate," after which the next technological jump begins from a lower level than where the previous one ended (Imai 1986, p. 26). It is thought that this can only be avoided if the innovative jump is associated with continual development and improvement work (Imai 1986, p. 27). By combining innovation and continual development, it is possible to achieve continually progressing development.

However, there are justifications to assume that the above-described models do not accurately describe the progress of process innovation. By its nature, technical change is a social process, which indicates that technology and innovation-centred thinking, on their own, cannot explain the implementation process of technical systems (Hyötyläinen 1998; Fichman & Moses 1999). There are studies according to which original technical change independent of how radical is always lower as far as performance ability is concerned than the system it replaces. Only by means of persistent development work will the new system reach the level of the previous system and possibly even exceed it. This is the only way one can reach the potential of the new system and implement it (Nord & Tucker 1987, pp. 3–39; Hyötyläinen 1998).

Even this picture can be clarified. In Figure 9, we see a clarified model. The first clarification pertains to planning activities. The dotted line, which represents planning, indicates that planning activities are not the same as linear system definition and planning. Innovation is not ready and does not occur instantaneously. It is rather a question of many small steps and incremental innovations, as well as improvization (Ciborra 1999; Sahal 1981; Nooteboom 2000). This occurs through social processes in which many parts of an organization participate with different objectives and interests (Torvinen 1999). There is also evidence that in the planning of information systems, the methods used are not very systematic (Rossi 1998; Hyötyläinen 1998). In any case, the planning of information systems is a process, which can take the organization many years. In addition, the planning activities have close links to the system suppliers and to possible system consultants, which can further complicate the planning work, because, in planning work, there is a collision between various

approach methods, objective methods and organizational modes of action (Tolvanen 1998; Browne & Ramesh 2002; Zhong & Majchrzak 2004).

Another clarification pertains to implementation. As indicated in Figure 9, at the beginning of the implementation, the new system falls short of the level of the previous system. Implementation activities involve many changes and innovations through of which attempts are made to adapt the system to the organization and vice versa (MacDonald 1998, pp. 32–33). The question is also of the development and assimilation of new competence and collaboration modes (Feeney & Willcocks 1999). The term "re-invention" has been used to describe these activities that one refers to as innovation changes during the implementation stage (Rogers 1995, pp. 172–180). In connection with implementation activities, one encounters numerous problems and disturbances, which require new solutions and changes to the system. In this regard, one must see the line between planning and implementation as being a little less clear. One can say that planning continues during the implementation stage (Ehn 1988; Brown 1991; Winter 1996). It is not enough that the user can use the system. He must also be able to include it in his own work, identify the organizational cooperation conveyed by it, as well as be able to act using it in exceptional situations and to develop his work (Reijonen & Toivonen 1996; Norros 1996 and 2004). This has an effect on approach methods and the methods used both in planning and implementation as well as on the applicable organizational forms (Lyytinen 1986; Boedker & Gronbaek 1996; Hong & Kim 2002).

The third clarification applies to continual development activity as part of the system. The potential use of the system requires continuous development work in system activities. The removal of problems encountered in use, as well as the use of new opening possibilities, can only be successful by means of continuous development work. This development work will be most successful if it is based on long-term user experience. In this case, we will speak of "learning-by-using" (Rosenberg 1982, pp. 120–140; Zuboff 1988; Eriksson & Nurminen 1991). An interesting question is how the system's planning knowledge and models could be used during development work performed while the system is in use (Metcalfe 2002; Pahl 2004).

The fourth clarification pertains to use and development activities. The basic concept is that the development of systems occurs as a gradual activity and as a

progression based on the principles of the learning curve and the routinization of activities (Rajagopal 2002). This picture may be incorrect. The system has observable implementation stages (Hyötyläinen 1998; MacDonald 1998, pp. 40–43; Marchand et al. 2001, pp. 17–28). The reasons for these implementation stages can be varied. One central point is change in the system's technology, products or organizational changes. It appears that, during use, the implementation stages cause a decrease in system levels in the same manner as during the actual implementation stage. This affects the organizational systems' objectives, operating modes and methods. The lines between development and innovation, as well as use and planning, become blurred. This implementation stage, during use, requires, in addition to development, more new innovative solutions (Hyötyläinen 1988; Norros 1996; Nooteboom 2000, pp. 170–189; cf. MacDonald 1998, pp. 1–6; Pahl 2004).

4.2.4 Activity model for implementation

The technical system's implementation process model presented above opens the possibility of reviewing the information systems' implementation process from the perspective of various actors and actor networks (Hietanen 1993; Hyötyläinen 1998; Kuutti 1994; Fichman & Moses 1999; Hanseth et al. 2004; see Burgoyne 1994; Blackler 1993; Engeström 1987; Edwards 2000). Below we will discuss the activity model pertaining to the implementation of the information system for the end-user organization. Through the activity model we will emphasize the meaning of different views of actors and of their interaction to the implementation process.

From the activity point of view, the company can be seen as being composed of different levels and strata, and their diverse models and views, forming a system of activity (Kanter 1983; Blackler 1993; Engeström 1987 and 1999; Hyötyläinen & Simons 1998; Kilpinen 2000). Company development activities can be considered to consist of three different levels, to which there are also related development cycles at different levels, which create tension and conflict in the activity of the organization (Hagström & Hedlund 1998). Using the model of business activity and its three levels, we can examine the nature of business activity change and development. Through this, the implementation of information systems can be studied from a new perspective (MacDonald 1998).

In Figure 10, the levels of business activity and their development cycles are illustrated.

The levels of business activity change can be outlined as three development cycles: the strategic development (planning) cycle, the systematic development cycle and the continuous change cycle. The levels differ from each other both in terms of the time span of the changes and their systematicity (Fujimoto 1998; Gallivan et al. 2003).

In *strategic development*, the company's management in particular follows what happens inside the company and within its environment. Based on this, they form visions and objective models and make plans for how the company should operate in the future. This refers to the company's strategic level and field of management (Cyert & March, 1992; Räsänen 1986). However, strong arguments are presented regarding the strategy being, by its very nature, "emerging" and proceeds by a stage-by-stage process, through the interaction of the top-down and bottom-up processes in an organization (Quinn 1980; Mintzberg 1994; de Kare-Silver 1997; Mintzberg et al. 1998, pp. 3–21; Regner 2001).

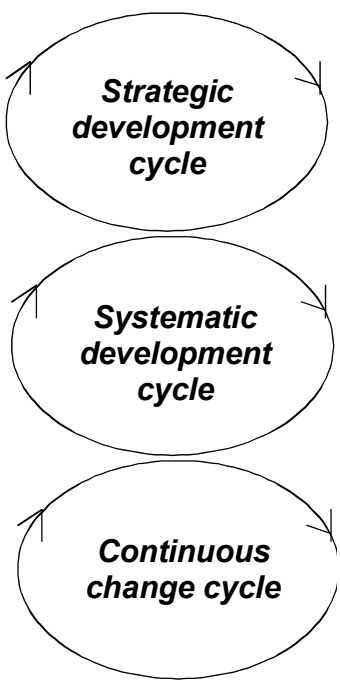

Figure 10. Three development cycles of companies (Hyötyläinen 2000, p. 63).

Normally, it is seen that the planning of the information system project and the selection of the system, as well as the requirement definitions, will come during the later stages of the strategic planning (Earl 1999; Al-Mashari & Al-Midimigh 2003; Rajagopal 2002). Central measures in this stage are the requirement definitions, based on business activities and their development, for the system to be selected, the negotiations and bid request round with the software suppliers/the system integrators, and the actual selection of the system itself (Cassidy 1998; Laudon & Laudon 2000; see Avison & Fitzgerald 1999; Rajagopal 2002). In that phase it will be emphasized that the organization's requirement definitions form the basis for the selection of the system. By means of a thorough requirement definition, which takes into account different functions and processes, one can ensure that one reaches the required final result (Sauer 1999).

From the business activity system's point of view, information systems are normally directed at modernizing processes and operations (Davenport 1993; Boehm & Port 1999; Al-Mashari & Al-Midimigh 2003). In this sense, the question is on the level of *systematic development* cycle, as presented in Figure 10. Middle management through systematic development activity attempts to reach the set goals and follow them until they are met. Development measures may be focused on the company's production system structures, such as information systems, organization and modes of operation, organization-management methods, business processes, etc. (Womack & Jones 1990 and 1994; Davenport 1997; Avison & Fitzgerald 1999; Edwards 2000). The shaping of these structures and processes that form the company's infrastructure often occurs more or less systematically while the projects are being carried out. In this regard, there are normally two basic issue that makes it hard to formulate or change information systems.

In principle, the most significant problems are associated with the various links between the different functions in the activity process. This type of problem is related to communication breakdowns and the difficulty in information transferrance (Szulanski 2003). Furthermore, efficient management of activity processes is complicated by differing functional objectives that conflict from the perspective of the whole company and by the mutually differing views, perspectives and activity modes of functions and their actors that are connected with these objectives (Rummler & Brache 1990; Davenport 1993; Hammer &

Champy 1993; Ashkenas et al. 1995; Holtham 1994). Another problem is that the investments in information systems and the related structures are planned for the long term. Therefore, a company's strategic focus often changes faster than these structures and processes (Farbey et al. 1999). This creates tension, because the infrastructure does not change as quickly as needed.

Information systems and the information therein will be realized only in use (MacDonald 1988, pp. 32–33). This pertains to the operative level in an organization, which is illustrated by *continuous change cycle*, as illustrated in Figure 10. The practical use of the information system is implemented as operational activity in an organization (cf. March & Simon 1958; Clark & Starkey 1988, pp. 105–122; Zuboff 1988). The third level of development cycle describes flexible and context-based routines and problem-solving activities, which contribute to adaptation to the operative demands of the activity environment (Coriat & Dosi 1998; Felman 2000). Since both the customers' needs and the availability of the company's own resources constantly vary, the organization always faces new situations. Thus the company has to rely on its employees' expertise and skills to cooperate with and adapt to new situations (Rosenberg 1982, pp. 120–140; Imai 1986 and 1997; cf. Aldrich 1999). In their development activities, companies might have to face the limitations set by their infrastructure, complicating their adaptation to development needs as determined by activity.

4.2.5 Interaction and learning model

The application of information systems occurs through the cooperation and interaction of many parties in the organization and between the organizations, as indicated above. Viewing the planning and implementation of information systems from the perspective of a developing social activity brings into view the fact that organizations learn and create new practices and supporting methods as the processes progress (Lowendahl & Haanes 1997; Vicari & Troilo 1998; Dalcher 2003). Thus, the planning and implementation processes of the information systems can be approached from the perspective of organizational learning and innovation processes (Tushman & Nadler 1986; Clark & Starkey 1986; Garvin 1993; Sitkin 1996; Hyötyläinen 1998; Feeney & Willcocks 1999). The starting point is the idea that the realization of the information systems does

not occur until they have reached the end-user enterprise and end users (Lee 1999; Dalcher & Genus 2003). Without conscious organizational learning processes, the potential of new systems cannot be used fully. The learning process can reach across organizational boundaries. The supplier firm can learn new things about every project in order to develop his own activities, as well as the customer processes and his product concepts (cf. Nonaka & Takeuchi 1995; Dixon 1999 and 2000).

The problem lies in the fact that the learning processes do not occur automatically. Although organizations encounter problems and difficulties, this does not necessarily lead to conscious learning, even within individual companies – not to mention learning processes occurring across organizational boundaries (Argyris 1992; Nonaka & Takeuchi 1995; Reijonen & Toivonen 1996; Dixon 1999; Preskill & Torres 1999; Zhong & Majchrzak 2004).

Often an organization's actors and functions are not used to present issues clearly based on model thinking. Accounts of issues are often recounted verbosely and disjointedly (Hyötyläinen 1998; Checkland & Holwell 1998; Preskill & Torres 1999). Thus, it is understandable that the very actors and functions involved have difficulty in learning each other's activity logic and starting to build a new activity model together. The idea is that there is much knowledge within an organization, though it is primarily connected to individuals and their various views, as well as their functional routines (Polanyi 1983; Nonaka & Takeuchi 1995; March & Simon 1958; Nelson & Winter 1982).

One could justifiably state that the implementation process of the information systems is carried out and defined through organizational measures. It is ultimately a question of organizational-learning and knowledge-creation processes (Hyötyläinen 1998; Prange 1999). It is only through these processes that the information technology potential can be fully used. Many different parties participate in the implementation process and all have different interests, objectives and methods, which can facilitate the learning processes. However, the presence of the viewpoints of actors does not, as such, guarantee the start of the learning and knowledge-creating processes within the organizations (end-user organization and supplier firm) and their cooperation with each other. The learning process requires conscious organizational practices, cooperation

methods and communication tools (Engeström 1994; Hyötyläinen 2000; Nonaka & Takeuchi 1995; Preskill & Torres 1999).

It is essential to create methods for the learning processes and knowledge transfer among the various levels in the development cycles and, of course, the entire process of the planning and implementation. Figure 11 shows a model, which describes the planning and implementation process and its interaction and learning cycles, as well as the knowledge creation processes that occur among them (Kettunen & Simons 2001; Simons & Hyötyläinen, 2001).

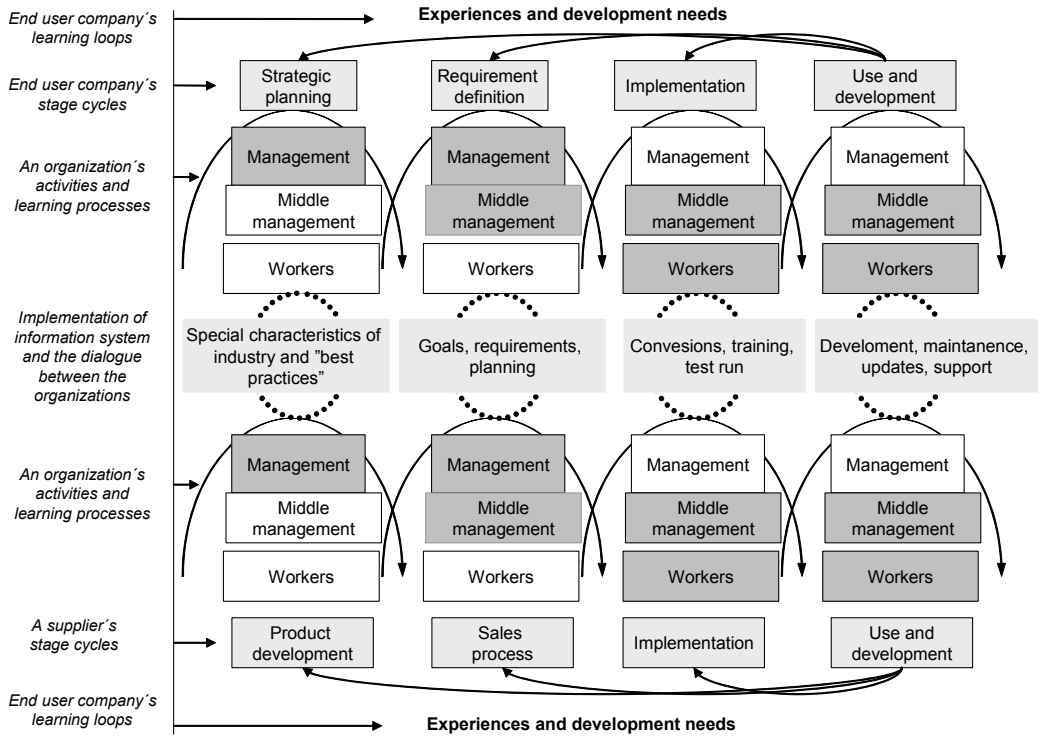

Figure 11. An interaction and learning model for the planning and implementation of information systems.

On top we see the development cycles for the company, which will bring the information system into use. In the model, four different stages and their cycles are separated in the case of an end-user company (cf. Figure 8). However, at the bottom are the development cycle model and its four stage cycles for the

supplier of the information system. The model also illustrates the stages of the implementation of the information system, as well as the organizations' dialogue and information exchange processes during the various stages (cf. Isaacs 1999). Furthermore, the model also shows both the learning processes and loops for both organizations.

In both development cycle models, a three-level organization is distinguished among each stage cycle: management, middle management and workers (cf Figure 10). One can see, in the planning and implementation process of the information system that in the various stage cycles, the participation responsibility is distributed among various organization levels and actor networks (Hanseth et al. 2004). This creates a challenge for the organization of the various stages of the development cycle, as well as for the methods to be used. The organization and methods should guarantee that, in each stage cycle, there are conscious learning and knowledge-creating processes. A large part of the information is often tacit knowledge within the organization (Baumard 1999). The organization manners and the various methods should support the transformation of tacit knowledge into explicit knowledge (Nonaka & Takeuchi 1995). This also facilitates the information transfer between the stage cycles (Dixon 2000; Szulanski 2003). This does not work by simple information dissemination. In any case, some of the information is difficult to formulate into explicit knowledge, which requires the organization of the implementation of the information system so that one ensures that critical tacit knowledge is transferred from one stage to another (Choo 1998; Baumard 1999). This type of organization is also essential for transferring explicit information from one stage to another, since the significance of the information depends on its interpreter (Dixon 1999 and 2000).

Some of the information regarding the implementation of the information system comes from the supplier. The information from the supplier is often difficult to interpret for the end-user enterprise, which can lead to misunderstanding and, because of this, reluctance within the corporation to cooperate (von Hippel 1998). In order for it to be possible to improve and facilitate cooperation as well as learning and information transfer, it is important that one identify the dialogue and communication processes among the companies as a solid part of the implementation of the information system. Through this, one will attempt to create methods to manage and develop the dialogue and communication

processes among the organizations (Sparrow 1998; Isaacs 1999; Vesalainen & Strömmer 1999). This also serves the supplier's own learning and knowledge-creation processes.

The model, presented in Figure 11, highlights the meaning of actor networks and the need for the overlapping between different actor networks (Dalcher 2003; Mähring et al. 2004). It is to been seen that the importance of learning loops is growing in actor networks (Argyris & Schön 1978; Argyris 1992; Nonaka & Takeuchi 1995). The importance of the end-user enterprise's learning loops is based on the information systems having a more central role than before in the actions of companies (Rajagopall 2002; Al-Mashari & Al-Midimigh 2003). Companies are forced, as part of their strategic development and planning, to prepare separate information management strategies (Cassidy 1998). In their design, it is important to know the systems' user experiences and development needs. From the perspective of the activities of the software firm and the development of products, it is essential to arrange efficient learning loops between the supplier firm's different stage cycles. This feedback is extremely important from the perspective of product development. Systematic information that has been collected regarding the implementation of information systems is also very important in the development of processes and methods that support implementation (cf. Preskill & Torres 1999).

4.2.6 Dialogue process

As presented above, the implementation of the end-user company's new information system and the development of the action methods require sufficient cooperation and discussion about activities and their development within the organization at the various stages of the each development cycle and in between cycles (Nonaka & Takeuchi 1995; Dixon 1999; Hyötyläinen 1998; Zhong & Majchrzak 2004). Though the communication and dialogue processes, which occur in the various development cycles of the planning and implementation process of information systems, new information is created and disseminated and the actors give this information meaning (Weick 1995), and through the communication and dialogue process (Isaacs 1999), it is possible for participants to form a common view of the development of the information system's definitions, implementation and methods (Choo 1998; Preskill & Torres, 1999;

Edwards 2000). This communication and dialogue process plays a deciding role in organizational learning and the creation of new knowledge (Stacey 1996; Dixon 1999; Hyötyläinen 2000). This also supports the efficient implementation of the information system within the organization (Checkland & Holwell 1998; Hyötyläinen 1998; Sarker & Lee 2002, Zhong & Majchrzak 2004).

It could be stated that promoting the implementation process of the information system and the arrangements of the associated planning and development activities in participating organizations requires that the various functions, and, in particular, their key personnel, need to have the ability to scrutinise activities from various perspectives, i.e., "on a meta-level", which means reflective thinking about the activities and its foundation and about the modeling used to further it (Schön 1983; Engeström 1994; Scarbrouggh 1999; Preskill & Torres 1999; Zhong & Majchrzak 2004). One could say that a working communication and dialogue process and the use of methods and tools supporting it can be said to promote the evaluation of the activities and its development foundations (Nonaka 1991; Nonaka & Takeuchi 1995; Grant 1996; Spender 1996; Hyötyläinen 1998; Isaacs 1999).

Communication within the planning and implementation process of the information system and dialogue pertaining to the information system development work can be seen as a central part of the organization's information system and its definition (Checkland & Holwell 1998; MacDonald 1998; Preskill & Torres 1999). This dialogue and communication system promotes information transfer and knowledge management through which the organization supports its activities and their development (Blackler 1993; Grant 1996; Spender 1996; Sparrow 1998). Due to its nature, this kind of information system can be considered flexible and changeable as required by the situation. This is possible because a number of different methods are used. The simplest and most natural part of the information system is the everyday dialogue between individuals (Norros 1996; Isaacs 1999; Preskill & Torres 1999). Other methods and procedures, which belong to the system are, for example, pre-planning, and prepared discussions, various documents and formal work tools (Hyötyläinen 1998 and 2000; MacDonald 1998). A growing part of these activities is based on using IT tools. The company's informations system can be used as a foundation, as well as its use as a support for the business activities.

4.2.7 Concluding remarks

In the chapter the implementation of information systems in an organization is analyzed by means of concept models and their relationships. With the help concept models the phenomenon concerning the implementation of the information system was defined. Based on modeling work, the interaction and learning framework for the implementation of information systems was created and analyzed. The dialogue process is shown to be as a central means to the realization of the information system and to the building of the information base in the organization.

Normally, it has been assumed that the decision concerning the implementation of an information system is based on a deliberate strategy, as well as different implementation steps are seen as logical and consistant measures (Cassidy 1998; Curtis 1998). This kind of view is based on decision-centred approach where the uses of information technology are linked to decision making in business (March & Simon 1958; Cyert & March 1992). The results and activity concept models created in the chapter, make it clear that this kind of the linear model of technological change is not a valid view, as well as that is not a relevant approach to the implementation of information systems (McDonald 1998, pp. 45–46; cf. MacKenzie & Wajcman 1987, Rosenberg 1976 and 1982; Sahal 1981). Another gap, which is still, in spite of it all, wide, is the relationship between information technology and knowledge use in businesses (Marchand et al. 2001, pp. 1–4). Through the develod activity model and related concepts, new means are created for crossing this line (Corbett et al. 1991; Gjerding 1992). The analyzed interaction and learning model brings out the need for the use of knowledge in business activities and their development where learning and innovation steps are raised as essential factors for the implementation of information systems (MacDonald 1998, pp. 40–43; Marchand et al. 2001, pp. 17–28).

4.3 Planning models and approaches

4.3.1 The Dilemma of planning models

It has been acknowledged that the adopted planning models hold great significance for the implementation process and use of information systems (Davenport 1997; Hyötyläinen 1998; Avison & Fitzgerald 1999; Dalcher & Genus 2003; McBride 2003; Dalcher 2003; Ho et al. 2004). According to research, the results achieved can also be considered to be centrally dependent upon the planning process of information systems, as well as their forms and methods (Checkland & Holwell 1998; Gottschalk 1999; Leem & Kim 2004).

There are various planning models that differ from each other in many dimensions. Previously, information systems were primarily viewed from a technical and planning method-centric view (Avison & Fitzgerald 1999; Checkland & Holwell 1998; Iivari & Lyytinen 1999). However, the planning and implementation of information systems is a complicated process, which involves issues regarding technical and organizational changes (Davenport 1993; Hyötyläinen 1998; Hong & Kim 2002; Doherty et al. 2003; see March & Simon 1958; Burns & Stalker 1994). It has become as a common view that there is a need to achieve a balance between technical change and organizational change (Ehn 1988; Mumford 1999 and 2001; Feeney & Willcocks 1999; Hong & Kim 2002; Doherty et al. 2003).

This type of approach can be considered to correspond to the assumptions of the socio-technical tradition (Trist 1981; van Eijnatten 1993; Mumford 1999 and 2001; Herrmann et al. 2004). Socio-technical theory views an activity system as a "socio-technical" system. The view is that the task is the mutual optimization of these two systems, since the optimization of each system separately does not lead to optimal solutions from the perspective of the entire "socio-technical" system.

However, there are reasons to say that the socio-technical approach does not provide sufficient grounds to bridge the gap between the technical system and the social system. This can be considered a "design dilemma" for technical change or innovation (Holbek 1988; Gjerding 1992; Ehn 1988; Hyötyläinen 1998). In order to solve a "design dilemma" for technical change, one must

analyze the planning of the information system, its implementation and use as a social activity and change process (Kuutti 1994 and 1999; Edwards 2000; Doherty et al. 2003; Hanseth et al. 2004; see Blackler 1993; Engeström 1999).

Recently, socio-technical concepts are, however, becoming more comprehensive and systematic (Checkland 1999; Herrmann et al. 2004). New approaches are based on system theoretical views as well as on activity theoretical suppositions. It has been emphasized that this kind of view helps identify appropriate concepts to describe and model the real aspects of socio-technical systems, which are planned and modified, and developed through situated action (Herrmann et al. 2004; Suchman 1987). Modeling methods are also developed for the purposes of planning and design socio-technical systems, when activity networks, as well as the differing perspectives of stakeholders are, at the same time, taken into account in model building.

In this study, a new concept, a use-oriented model for the planning of information systems will be outlined and analyzed. The implementation process of an information system can be seen as planning and use activity (Lyytinen 1986; Kuutti 1994 and 1999; Norros 2003; Dittrich & Lindeberg 2004). According to this, the innovation processes involved in technical change are not considered to be limited to occurring during the planning stage and not as ending at the implementation stage. Thus, the connection between planning activity and use activities becomes a central perspective. In the study, we will create a new planning model. First, we will review the planning and use activity model. From this basis, we will create a framework for use-oriented model. Finally, we will analyze the dimensions of the use-oriented planning model. As part of the model, the meaning and effects of user activities are outlined and analyzed.

4.3.2 Towards use-oriented planning appoach

The planning and implementation models can be seen to form the reference framework for describing and analyzing the planning and implementation process of information systems in organization (Hyötyläinen 1998; Checkland & Holwell 1998; MacDonald 1998, Avison & Fitzgerald 1999). The analysis of the planning and implementation models refers to the fact that the planning paradigm has influence on whatever is seen as the aim and objectives of the

planning and an object of design. That has again a solid link to the way of organizing the planning and implementation activities (Hyötyläinen 1998; Gottschalk 1999; Ho et al. 2004).

In the creation, planning and implementing of technical systems, it has been customary to distinguish between two opposite strategies (Hellman 1989; Brödner 1990a, b; Lay 1990; Rouse 1991; Davenport 1993; Hyötyläinen 1998; Lee 1999). These opposite planning and implementation strategies have been referred to as "techno-centric" and "user-centric" strategies.

The techno-centric model focuses on the planning of the technical operation of information systems, which takes place in a highly specialized and segmental planning organization (Hyötyläinen 1998; Avison & Fitzgerald 1999). It is also characteristic that the planning of information systems takes place separately and the division of work between planning and operation is strict. The techno-centric model is well-known. Its aim can be seen to be an "unmanned operation". It has been acknowledged that large gaps exit the social and technical sides in the management and development of information systems managed by engineering-based approaches (Brödner 1985; McBride 2003). The main focus is product or software qualities, such as a low number of errors, certain real-time attributes and as high technical properties as possible. However, usability is a problem for software development done according to the techno-centric approach (Dittrich & Lindeberg 2004). Despite many warnings, this model is widely used even today in the introduction of new information systems (Checkland & Holwell 1998; Lee 1999; Avison & Fitzgerald 1999; Doherty et al. 2003).

Instead, the so-called user-centric model, based mainly on the socio-technical approach, aims at the planning of user-centric systems. The users participate in the planning. The user-centric model is seen to open new opportunities in the implementation of new technology. It is also a widely preferred model in the implementation of information systems (Ehn 1988; Hellman 1989; Lee 1999; Mumford 1999 and 2001).

In recent research, there emerged the possibility of a planning and implementation approach, which deviates from the two previous strategies. The discussion regarding this alternative has received impulses from the critical evaluation of practices in the user-centric strategy, as well as from the need for

new approach methods (Ehn 1988; Corbett et al. 1991; Hyötyläinen 1998; Lee 1999; Herrmann et al. 2004). One answer has been the development of soft-system methodology (Checkland & Scholes 1990; Checkland & Holwell 1998; Checkland 1999; Rose 2002). According to this approach, information technology is considered to be, by its very nature, potential technology. This includes the idea that information technology and information carried via this technology cannot be realized until it has been implemented and used (McDonald 1998, pp. 32–33; Lee 1999; Lyytinen 1986; Irani 2002; Norros 1996 and 2003; Al-Mashari & Al-Midimigh 2003).

It has been noted that there are possibilities to form a new kind of approaches to plan and implement information systems. User-centric emphasis and evolutionary development view have been raised to higher position than before within requirements determination, planning and implementation tasks (Vicente 1999; Jones 1989; Gottschalk 1999; Hong & Kim 2002; Doherty et al. 2003; Wang & Tai 2003; Benediktsson & Dalcher 2003; Pahl 2004; Ho et al. 2004; Greer & Ruhe 2004). The activity view on planning and implementation has been brought forth for discussion more than before in the introduction of information systems (Browne & Ramesh 2002; Metcalfe 2002; Bai & Lee 2003; Hanseth et al. 2004; Kauppinen et al. 2004; Mähring et al. 2004). *Use-oriented development* of information systems has also been specified in some corners (Norros 2003; Dittrich & Lindeberg 2004). The connections and relations between users and developers and their activities have been seen as a central factor for the usability of systems.

4.3.3 Planning and use model

We will present a use-oriented model as a new planning concept that is based on activity view. A central point is to cross the line between planning activity and use activity for information systems (Vicente 1999; Norros 2003; Dittrich & Lindeberg 2004). The activity view to planning and use can be illustrated by a planning and use activity model (Figure 12).

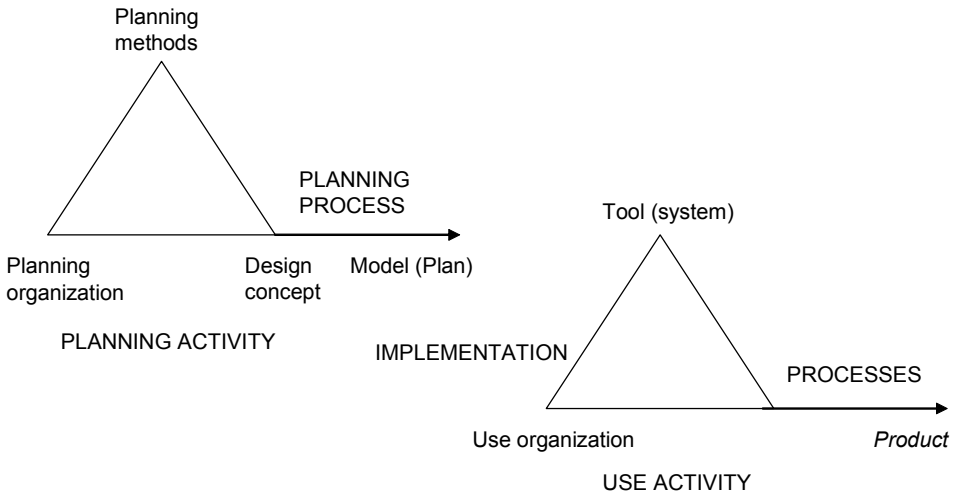

Figure 12. Planning and use activity model.

In the model, there are two systems, planning system and use system, which implementation connects to each other in the final place. Both systems are activity systems, whose elements are organization, methods, and processes in which the transformation process progresses and happens (Lyytinen 1986; Engeström 1987 and 1999; Kuutti 1994 and 1999). In the case of a planning activity, the transformation process concerns that of how design is formulated and converted into the model and plan of a system. With regard to use activity, the transformation is the process through which an object of the use system is converted into products.

At the beginning phases of planning stage, based on the goal and requirement definition emphasizing use-oriented nature of demands (Browne & Ramesh 2002; Chiu 2004; Pahl 2004), a design concept is formulated in which we will in fact present a preliminary model of the objectives of the change that we are trying to implement, the object of the planning and what kind of system is wanted (Hyötyläinen 1998; Avison & Fitzgerald 1999; Zoryk-Schalla et al. 2004).

The design concept will be changed to a model and a plan for the desired system through planning efforts (Wang & Tai 2003). In principle, planning will include two entities. One is the actual system planning and software development (Pahl 2004). The other is the organization planning, which may pertain to user training

and organizational solutions (Doherty et al. 2003). The planning is carried out as a planning activity. During the planning process, the established planning organization will use various planning methods in preparing a model and plan (Sohn & Doane 2002; Chiu 2004). The model created during the planning stage will be fine-tuned and detailed during the implementation planning stage or construction phase (Leem & Kim 2004). During the implementation planning stage, one must also define the implementation actions (Gottschalk 1999).

A plan will be changed to a concrete system during the installation and start-up stages of implementation. A successfully implemented system will become a tool for the use organization and users. During the use activity, the use organization and users try to use the system in its normal activities and in enterprise processes, as well as when processing, producing and delivering products (Engeström 1987; Kuutti 1999; Vicente 1999). The results of the system's implementation will be measured against this (Hyötyläinen 1994 and 1998; Farbey et al. 1999; Marchand et al. 2001; Irani 2002; Gallivan et al. 2003).

The planning and use activity model, presented in Figure 12, includes a new view of the relationship and connection of planning and use activity, which requires a new planning model for information systems. The requirement is that planning and use activity are more closely integrated than before (Feeney & Willcocks 1999; Doherty et al. 2003; Norros 2003; Dittrich & Lindeberg 2004; Ho et al. 2004). According to the model, it is not sufficient that planning is focused on a purely technical system. The objective of the planning has to be the entire techno-organizational use system, which is considered to be an activity system, which is developed while being used (Lyytinen 1986; Kuutti 1994 and 1999; Herrmann et al. 2004).

4.3.4 A Framework of use-oriented planning model

According to the planning and use activity model, as presented in Figure 12, the creation of an efficient technical system requires a change of the planning organization and the implementation method, so that the users participate in the planning process and the implementation is considered an extension of the planning. This qualitatively new planning model can be called use-oriented planning (Toikka et al. 1986; Hyötyläinen et al. 1990; Hyötyläinen 1993, 1994

and 1998; Simons & Hyötyläinen 2001; Norros 2003 and 2004; Ehn 1988; Checkland 1999; Dittrich & Lindeberg 2004). Below we will discuss new cooperation forms and planning models and methods, which are required for the integration of planning and use activities.

The more intense functional integration between planning activities and use activities, which are required by use-oriented planning, can be viewed using the dimensions, which are the most significant for crossing the line between planning and use activity (Figure 13).

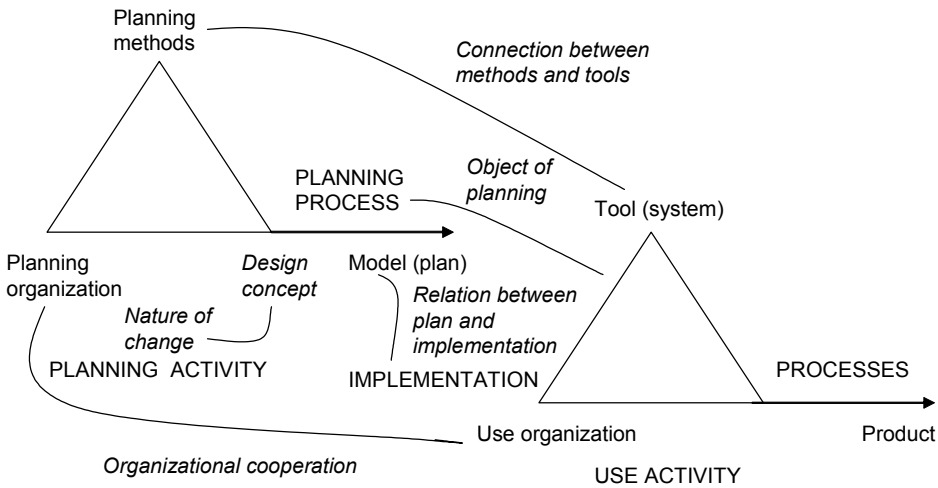

Figure 13. Dimensions of use-oriented planning model.

We can distinguish the following five dimensions that characterize use-oriented planning:

- the connection between the nature of the change and the design concept
- the connection between the planning process and use activity (in other words, what is the object of planning?)
- organizational cooperation between the planning organization and use organization
- the relationship between the plan and the implementation

- the connection between the planning methods and the methods and tools of use activity.

In the following, the use-oriented model will be analyzed through these five dimensions. My approach is a more extensive and theoretical one than the use-oriented development model or practice presented by Dittrich and Lindeberg (2004). They emphasize mainly co-operation between users and developers. They see this as a central factor for gaining more usable information systems. In addition, their approach is chiefly based on the description of a case, although the case is very revealing with regard with the characteristics of use-oriented practice.

4.3.5 Dimensions of use-oriented planning model

Below the hypothetical model for use-oriented planning is described through these five dimensions, which are outlined in Figure 13.

4.3.5.1 The Connection between the nature of the change and design concept

The realist evaluation of *the nature of the technical change* associated with the planning and implementation of the information system is a significant factor in decision-making regarding the system and the development organization, in spite of differing views regarding the changing of processes (Dosi 1988; Hietanen 1993; Choo 1998; Galliers & Swan 1999; Edmondson & Moingeon 1999; Edwards 2000; Regner 2001; Browne & Ramesh, 2002; Dittrich & Lindeberg 2004; Herrmann et al. 2004). From the perspective of a successful technical system, it is also of utmost importance to realistically define the nature of the change, because it primarily will determine the use organization, the training program and the implementation model (Earl 1999; Feeney & Willcocks 1999; Hong & Kim 2003; Doherty et al. 2003). From the viewpoint of successful change, technical change should be seen as a fairly large technical and organizational change process (Checkland & Holwell 1998; Al-Mashari & Al-Midimigh 2003). Finally, the nature of the change should be viewed as an organizational development process (Hyötyläinen 1998; Vicente 1999, pp. 109–

136; Norros 2003). Organizational factors can become obstacles to successful implementation and, thus, endanger achieving set objectives.

The connection to the *design concept* is closely associated with the nature of the change. The design concept is an important starting point for the planning organization, the planners, and planning practice. The design concept directs the work of the planners and controls the search for solutions. Thus, the design concept significantly affects the planned technical system and an implementation model (Iivari & Lyytinen 1999). According to the developed model presented in Figure 13, two dimensions define the design concept. First of all, the design concept should pertain to the entire use activity system. Second, the object of the planning should be perceived as a continuously developing activity system (Winter 1996; Pahl 2004; Herrmann et al. 2004). This has a deciding role in the selected technical solutions and in the evolved organizational practices along with implementation and use. These organizational decisions play a significant role from the perspective of reachable results (Hyötyläinen 1988; Hong & Kim 2002; Doherty et al. 2003; Leem & Kim 2004).

4.3.5.2 The Connection between the planning process and use activity

The final model and plan will come out of the planning process. The integration of planning activity and use activity is centrally dependent upon how one considers the system to be planned. An essential characteristic of the use-oriented planning method is the fact that it contains *a new view about the planning process's object* (Hyötyläinen 1998; Gupta 2000; Norros 2003):

- The objective of the planning is, instead of creating a purely technical system, to create a techno-organizational system, which is considered to be an activity system that develops while in use (Pahl 2004).
- Also related to the new view of the planning objective is the planning of the use organization and use activity, which ensures the management and development of this object – a techno-organizational system (Hong & Kim 2002).

This means that use activity becomes the determining criterion in planning activity, as Vicente (1999) also emphasizes in his formative approach. In order

for use activity to become the focus of planning, one would need an *integrated approach*, where technical decisions are viewed during the course of the planning process concurrently, as well as from the perspective of technical feasibility as from the use activity of the techno-organizational system. A central planning task is to plan and carry out organizational and use practices, which promote the organizational learning that is required by the techno-organizational innovation processes in system implementation (Sahal 1981; Brown 1991; Garvin 1993; Winter 1996; Hyötyläinen 1994 and 1998; Fichman & Moses 1999; Gallivan et al. 2003; Leem & Kim 2004). During the planning stage, one must create readiness and structures for the innovation activities related to implementation and use (Rogers 1995, pp. 172–180; Fichman & Moses 1999; MacDonald 1998, pp. 52–54; Norros 2003; Dittrich & Lindeberg, 2004). For this reason, it is necessary to add a functional connection between the planning organization and the use organization for the handling of planning and implementation problems (Ehn 1988; Boedker & Gronbaek 1996; Edwards 2000; Dittrich & Lindeberg 2004).

In the sphere of information systems design and development, there is ongoing discussion on how to improve requirements determination and its user-centricity (Ruhe 2004; Kauppinen et al. 2004; Pahl 2004). It has been acknowledged that user participation in systems development is an important factor in achieving system success. The main means for crossing the line between information systems technical planning and the demands set by the use organization and users is seen to be, on the one hand, the expansion and enhancement of requirements to have a better understanding of user behavior and perception (Browne & Rames 2002; Chiu 2004). However, one stance in information systems design concerns how to construct user models to achieve more user-adapted systems (Chin 2001; Sohn & Doane 2002).

However, in order for techno-organizational change and the use activity to become the objective of planning, one needs an integrated approach in which during the course of the planning and implementation process, technical solutions are viewed concurrently, both from the perspective of technical functionality and system use function (Vicente 1999, pp. 109–136; Norros 2003 and 2004). Avison and Fitzgerald (1999) state that the traditional model in which there are some sequential stages, like analysis, planning and implementation, does not correspond to the iterative nature of planning and implementation

activity. They present a new model for planning, implementation and use. According to this model, there are several chains of planning–implementation-use steps that follow with each other. This kind of concept, consisting of the features of holographic systems, offers a good chance of techno-organizational change and the use activity, becoming a focal point during planning and implementation efforts.

In addition to this, Dittrich and Lindeberg (2004) emphasize and show that use-oriented development requires flexibility in the development process, as well as flexibility in the use of different co-operation formats and organization patterns. Within software engineering, there is also ongoing discussion on incremental software development that is based on ideas using evolutionary approaches (Ciborra 1999; Fichman & Moses 1999; Benediktsson & Dalcher 2003; Pahl 2004; Greer & Ruhe 2004; Ruhe 2004; Peak et al. 2004).

Use-Oriented Views

In the following section, we go into more detail about analyzing the characteristics and essential features concerning to the *question of the relations between planning process and use activity*. According to the traditional "normative" approach, the following primary stages can be separated into the planning process of the technical system: (a) planning of a system concept, (b) detailed technical design, and (c) integration of technical plans (Rouse & Cody 1988; Curtis 1998). The definition of the use-oriented planning process and the course of the process will be analyzed below based on these stages.

(a) Planning of the System Concept

According to the traditional planning concept, the planning of the system concept occurs from the "top-down", where the planning problem is divided into sub-problems (Curtis 1998; Avison & Fitzgerald 1999). One starts from the system's "primary functions", which are divided into partial functions and, further into various levels of sub-functions. The result is a hierarchy, which describes the technical activity structure of the system (Meyer 1988, pp. 43–49). This type of planning activity easily leads to planning process progressing fairly directly from needs to the planning of the technical implementation, which

means that the objective of the planning becomes a purely technical system (Cassidy 1998). The objective of the plan is to have a system that fulfills the requirements of the "function tree structure". This means that the system subject to the review is modeled purely from a technical perspective. However, it has been shown that this planning activity, which progresses from the "top-down" cannot succeed without reviewing planning problems from the "bottom-up" as an analysis that is performed from the use perspective (Rouse & Cody 1988; Dorherty et al. 2003; Norros 2003; Dittrich & Lindeberg 2004).

Key areas for planning, which efficiently take into account the integrated approach and use activities, are requirement definition and system use functions. This is also a central task in the definition and implementation of information systems (Al-Mashari & Al-Midimigh 2003). Thus, the focus moves from purely technical systems to use activity. This makes it possible to make functional objectives and user functions important system concepts in the planning. The planning thus changes to "goal-controlled" rather than to "technically controlled." (Rouse & Cody 1988). The planning of a technical system that works well requires that the use activity and use organization requirements be already integrated into the system concept. In this sense, Vicente's (1999, pp. 109–136) formative approach to work analysis along with the planning and implementation process is an approriate methodology. According to this approach, work constraints are based on the focus of requirement identification and modeling (cf. Norros, 2003). The primary goal is to design future use activity and work practices, rather than to design the details of the device or system.

(b) Detailed Technical Design

According to the traditional view, the detailed technical design of the system includes process planning (system architecture and structure, processes and work flow) and the planning of the control system (functional definition, control structure, user interfaces) (Curtis 1998). Traditionally, the focus has been on process planning. However, planning the control and interactive system primarily focuses on building an efficient system (Rasmussen 1986; Vicente 1999). The control system should support the user's activities in managing the system. Personnel and organizational planning should also be subject to detailed planning (Doherty et al. 2003). It is no longer enough for the user's activities and the use organization to be viewed at the end stages of implementation

planning or at the point when the system goes into use, as has often been the case (Hyötyläinen 1998; Avison & Fitzgerald 1999).

(c) Integration of the Technical Plans

According to the traditional concept, at the integration stage, the detailed plans are integrated into a comprehensive system plan, which is tested for its ability to fulfill the original requirements of the system concept. Integration has previously been a separate stage at the end of the planning process. The result of this is that each detailed designs are optimized from the perspective of its own area and comprehensive optimization or even a real functioning is never achieved (Rouse & Cody 1988; Boehm & Port 1999; Dalcher 2003; Dalcher & Genus 2003).

The integration of the system's detailed plans into a comprehensive system must be a continuous activity during the planning process (Avison & Fitzgerald 1999). The various sub-areas of planning must be planned in parallel and incrementally, so that the techno-organizational activity system can be viewed as one functional whole along with the planning process (Greer & Ruhe 2004; Ruhe 2004; Pahl 2004). This requires that

- the control and interface system planning is linked more closely than before to technical process planning design (Rasmussen 1986; Vicente 1999).
- personnel and organization planning must be part of this parallel and incremental analysis, so that one can optimize the distribution of tasks between people and machines and plan challenging and developing tasks and an organizational structure that supports the continual development of the system (Eriksson & Nurminen 1991; Winter 1996; Hyötyläinen 1998; Feeney & Willcocks 1999; Doherty et al. 2003).

The continual integration of detailed plans can only succeed if integration is viewed from the perspective of the system's use activity, which is then linked to the cooperation mode and methods of the planning organization and the use organization.

4.3.5.3 Organizational cooperation between planning organization and use organization

The organizational changes in planning, such as including users in the planning, can strengthen the planning and, thus, the functionality of the plan (Doherty et al. 2003; Dittrich & Lindeberg 2004). In order to solve the integration problem between the planning process and use activities, it is important to strengthen the connection between planning and use organizations. This requires that the users join the planning process earlier and participate more extensively than we are accustomed to (Kanter 1983, pp. 241–277; Jones 1989; Boedker and Gronbaek 1996; Norros 1991 and 2003; Dittrich & Lindeberg 2004).

Participation in planning means that the knowledge of users and especially the knowledge acquired during system implementation is linked to planning. The participation of users in planning is significant in two different ways (Hyötyläinen et al. 1990; Hyötyläinen 1994 and 1998; Norros 1996; Hong & Kim 2002):

- by participating in the planning process, the users can adopt and transfer planning information into usage management, which can shorten the implementation period for the system
- the users may participate in the handling and solving of planning problems and, thus, add their usage knowledge to the plans, which can decrease problems and disturbances when the plan is operationalized in the implementation stage.

However, through these changes, even in the best-case scenario, one can only reach "participatory" planning in accordance with the user-centred planning concept (Norros 1991 and 2003).

4.3.5.4 The Relationship between planning and implementation

Use-oriented planning requires a closer connection than before between planning and implementation (Dittrich & Lindeberg 2004). It is central that planning be considered to continue through implementation as well as during use activities, as part of the cooperation of users, the use organization and the planning organization, as well as in the formation of the users' system-oriented work

mode (Nadler & Robinson 1987; Nonaka 1991; Sitkin 1996; Winter 1996; Hyötyläinen 1998; MacDonald 1988; Norros 1996 and 2003).

During the implementation stage, one must test, on the one hand, how successful the plan is, and, on the other hand, the implementation and degree of learning of system management as well as user management (Gottschalk 1999; Feeney & Willcocks 1999; Marchand et al. 2001, pp. 17–28). A requirement for successful implementation is the relinquishing of the traditional view that planning is "a panacea" (Gottchalk 1999; Zoryk-Schalla et al. 2004). As information systems are expanding and becoming more complex, it has become clearer than before that it is difficult to plan them so that one can consider all possible situation-connected use incidents and to predict disturbances—not to mention that one could create ready-made user procedures for all possible situations (Polanyi 1983; Suchman 1987; Brödner 1989; Lindberg 1992; Pahl 2004). The users and the use organization must be able to supplement, change and develop a technical system, because a planned technical solution is always incomplete and lacking (Rosenberg 1982, pp. 120–140; Norros 2003). This means a need to continue the planning process during implementation, which is a different view than the one expressed in traditional planning methods. It is also important to realize that, as an activity system, a technical system must also change and develop after implementation (MacDonald 1998, pp. 40–43). This is primarily required for a decrease in disturbances during use, as well as for the optimization and development of system functionality as the product line and activity circumstances change, and when technology develops (Hyötyläinen 1998; MacDonald 1998, pp. 1–6; Norros 1996, 2003 and 2004; Pahl 2004).

4.3.5.5 The Connection between planning methods and use activity methods and tools

Even in connection with the planning of "normal" systems, interaction and integration between technical planning that progresses "from the top-down" and use activities that progress "from the bottom-up" require better methods and tools than are currently available (Rouse & Cody 1988; Rossi 1998; Herrmann et al. 2004; Dittrich & Lindeberg 2004). The available models and methods for planning technical systems cannot cover the entire system-related multifaceted nature of the use requirements and the user activities (Rosenberg 1982, pp. 120–140; Hyötyläinen 1998; Torvinen 1999).

The lack of methods and tools becomes even clearer when the "bottom-up" review of the use activities is based on the use-oriented planning method, on the users' participation in the planning, and on the cooperation between users and planners (Kanter 1983, pp. 41–277; Boedker & Gronbaek 1996; Tolvanen 1998):

- The requirement for the actual participation of users in planning is training on system planning and implementation. The objective of training is to give the users a system-oriented work style, which is based on the adoption of system-planning knowledge. The training can also be used as a tool, which offers a new form of cooperation between planning and use. During the training, the users and planners gradually create and adopt general models and concepts concerning the system being planned (Kanter 1983; Norros 1991 and 1996; Engeström 1994; Hyötyläinen 1998; Dixon 1999 and 2000).
- When an information system is being planned as a functional and developing entity and the users and use organization participate in this planning work, the planning process can become a general training and planning process for the planners and users (Zong & Majchrzak 2004), which is supported by the system and use activity models and focused on the development of these models, which makes planning a real learning and innovation process (Norros 1991; Engeström 1994; Prange 1999; Metcalfe 2002; Zong & Majchrzak 2004). The modeling process can be used in the system planning to develop solutions. Thus, the knowledge accumulated during the learning process will gradually be integrated into the system and its activities and then lead to more advanced activity modes and procedures. As Vicente (1999, p. 112) states, it is a real invention to notice that a design team forms, in fact, a new way for people to work in their use activities. According to the approach, the focus is on the way of identifying novel possibilities for use activity and work practices.

By adopting, during planning, models and planning knowledge on the system, the users and the use organization can transfer this knowledge into the base for use activity. This means that it is easier than before to make changes during the implementation stage and the use activity. The difficulty in making changes has usually been caused by the fact that an actual foundation for planning has not been available for existing systems (Metcalfe 2002; Pahl 2004). Through the

models created during the planning process, the users and use organization can better analyze the system's functional problems and the development needs as part of the comprehensive system. Thus, the planners and users' common learning and training process, which started during planning, can continue during implementation and even during use as actions that are focused on the development of the system by the users and use organization (Dittrich & Lindeberg 2004). This requires from the users work orientation based on system development and experimentation and support of the development work on the part of the use organization.

4.3.6 The Importance and effects of user activity

The importance of user activity has often been under-emphasized in the information system implementation process and in the formation of evolving decisions (Jones 1989; Hyötyläinen 1998; Norros 1991, 1996 and 2004; Doherty et al. 2003). However, it can be said that, in the innovation processes associated with implementation, user activities are seen as a significant role. As Vicente (1999, p. 109) states, "By deliberately creating the conditions for productive adaptation, we can give workers some responsibility to 'finish the design' locally as a function of situated context". The users have to act as flexible and adaptive problem solvers. There are many decisions left to the implementation phase that cannot be anticipated by designers and planners beforehand in planning phase (Slaughter 1993).

The importance of the user activity is best manifested in the handling of the development of system functions and emerging disturbances (Vicente 1999; Norros 1996). Technical systems – also including information systems – are, by nature, integrated and complex systems (Amoako-Gyampah & Salam 2004). Considering that they constitute an expensive investment, they require good usability and functionality. Information systems, like ERP systems, functionally and chronologically connect the company's various activity processes, functions and different work stages closely to each other (Gupta 2000; Spathis & Constantinides 2003). In connection with this type of environment, work activities require from the users that they understand the system as a whole, and they need to consider the functional and productive situation (Zuboff 1988; Norros 1996; Reijonen & Toivonen 1996). The users must also be able to act in exceptional

situations and to remove problems and disturbances quickly (Coriat & Dosi 1998). Thus, the user must employ a system-oriented method of action, the basis of which is formed by an understanding of the system's functional principles and, based on this, the cooperation and communication between the users and the rest of the organization (Norros 1996 and 2004; Zuboff 1988; Hyötyläinen 1998).

This kind of activity that is mainly based on incremental innovations (through gradual and small incrementally occurring development work), which occur during implementation and use, and which are performed by users, supervisors and maintenance personnel in order to eliminate disturbances and problems and to develop the system functioning, play a central role in the functionality and economics of the system (Jones 1989; Eriksson & Nurminen 1991; Brown 1991; Felman 2000; Pahl 2004). Note that the economic significance of incremental innovations can be greater than the effect of radical innovations (Nooteboom 2000, pp. 171–189). This ever-increasingly more important type of innovation process, which has not been considered to a sufficient extent, and which probably has a growing importance from the perspective of the economy of integrated systems, Rosenberg (1982, pp. 120–140) calls it "learning by using" According to Rosenberg, learning by using can lead to improvements in system technology, improvements and increasing efficiency in system operating modes, and improvements in the service functions. According to Sahal (1981, pp. 36–38, 57–60), technical change is a development process based on innovation activities. Sahal (1981, pp. 108–122) is of the opinion that implementation progresses as a learning process, based on cumulative experience, due to which existing technology and systems are made more efficient and are continually developed. Thus, in production activities, one "learns by using" new innovative ways of improving the implementation of technology. According to Nooteboom (2000, pp. 171–189), by testing the limits of technological systems, one opens up new possibilities for innovation and new combinations, which may pertain to new practices, new technologies and organizations (Pahl 2004).

The function of the information systems is based on computer-based control. For this reason, the activities and control manifest themselves in models associated with activity processes and work activities (Zuboff 1988). For this system, it is not possible to master it without understanding and using these conceptual models, which are part of the foundation of the users' system-oriented action methods. The improvement of the usability and functionality of information

systems requires system-oriented development work, because, as an integrated technique, the development of information systems requires customized solutions. The adaptation of the system to the enterprise's activity system and product needs, as well as the optimization of the business activities, is a long-term process, which requires from the users improvement and development work directed at the system (Pahl 2004). This requires professional skills and development motivation from the users (Feeney & Willcocks 1999).

However, the users can act differently with regard to problem and disturbance situations, which occur in connection with implementation and use, as well as the development demands of the system (Norros 1996 and 2004). The users' common "user strategy" is significantly affected by the planning concept and implementation strategy adopted by the company management and the planners (Clark & Starkey 1988, pp. 105–122; Hyötyläinen 1998). Generally one can say that decisions based on a user-centric group organization type promote the formation of a system-oriented activity mode and the evolution of development motivation (Sandberg 1982; van Eijnatten 1993; Mumford 1999). This, for its part, improves the users' disturbance management abilities and their possibility of participating in the optimization and development of the system functions. The means of planning and implementation, and the organizational forms related to the use-oriented model, create for the user possibilities on a higher level for participation in the system's development work (Norros 1996, 2003 and 2004; Dittrich & Lindeberg 2004).

Users can also differ from each other based on their individual orientations (Norros 1996 and 2003; Hyötyläinen 1998). One possibility is that the user would even withdraw from problem situations. However, at the very least, the functioning of the information system requires that the user participate in the elimination of problems and disturbances in order to allow normal activities to continue. According to March & Simon (1958, pp. 12–22), even in a highly routinized environment, the routine has the character of "strategy" rather than a "fixed program". At its highest developmental level, the users' disturbance-orientation can lead to a consciously cooperative system, and even to development work that transcends these limits and creates cooperation among various segments of the use organization (Norros 1996).

4.3.7 Concluding remarks

In this chapter, planning concepts and implementation strategies are analyzed by using concept models and their relationships. With the help of concept models, we delineated the use-oriented planning model and its dimensions. This model facilitates the learning and innovation processes associated with the planning, implementation and use of information systems. The central characteristic in the model is the view of how to crossing the line between planning and use activities. User activities were assessed to be of great importance for the development of the system during implementation and use. The incremental innovations and change activity are a significant meaning to the economic aspects of systems.

The use-oriented planning model created and analyzed belongs to new traditions in the area of the planning and implementation of information systems in which evolutionary and incremental aspects of planning and implementation are emphasized (Vicente 1999; Gottschalk 1999; Hong & Kim 2002; Doherty et al. 2003; Wang & Tai 2003; Benediktsson & Dalcher 2003; Pahl 2004; Ho et al. 2004; Greer & Ruhe 2004), as well as from the view in which planning, implementation and use are seen as a social activity (Lyytinen 1996; Kuutti 1994 and 1999; Browne & Ramesh 2002; Metcalfe 2002; Hanseth et al. 2004; Kauppinen et al. 2004; Mähring et al. 2004). The use-oriented model has also recently arisen into discussion (Norros 2003 and 2004; Dittrich & Lindeberg 2004). The analysis and modeling work in the chapter bring forward the former treatment of the models and practice for the use-oriented planning and design.

At large, the views on the use-oriented planning model and its development in the chapter can be seen, on the one hand, belonging to the long tradition of evolutionary and innovation approaches (Rosenberg 1976 and 1982; Gould 1980; Sahal 1981; Nelson & Winter 1982; van de Ven 1986; Nelson 1987; Dosi 1988; von Hippel 1998; Silverberg 1990; Slaughter 1993; Winter 1996; Nooteboom 2000). On the other hand, the planning and use activity models and their analyses are, to a great extent, based on the premises of activity theoretical approaches (Lyytinen 1986; Engeström 1987 and 1999; Kuutti 1994 and 1999; Blackler 1993; Lowendalh and Haanes 1997; Kilpinen, 2000; Norros 2003 and 2004).

When assessing the meaning of the developed use-oriented planning model, in this chapter, one can state that concept models and their relationships are essential parts in constructing conceptual and theoretical knowledge, which serves, on the one hand, theory-building purposes when information systems are studied in different contexts and from different views (Scarbrouggh 1999; Sauer 1999; Jones 1989; Mumford 2001; Rajagopall 2002; Al-Mashari 2003; Sarker & Lee 2002; Zoryk-Schalla et al. 2004). In that sense, my approach is a more extensive and theoretical one than the use-oriented development model or practice presented by Dittrich and Lindeberg (2004). However, the created and analyzed model and its dimensions belong, by their very nature, to the model world (Sayer 1992, pp. 46–51). It has been presented that the central purpose of the model world and its concepts and terms, is, by definition, to emphasize such factors, which, based on the selected research approach method, are able to discern the object's essential characteristics and relationships, as well as the development and activity mechanisms (Laudan 1977; Sayer 1992; O'Donovan & Roode, 2002).

In addition, models are needed in conjunction with the information systems planning and implementation processes, as well as for analyzing development dimensions that affect the development of information systems in companies. As such, the use-oriented planning model can serve practical development work functions (Small & Yasin 1997; Checkland & Holwell 1998; Avison & Fitzgerald 1999; Herrmann et al. 2004).

4.4 A hypothetical model for researching information systems

4.4.1 Constructive research approach

Traditionally, research activities in the management studies and social science, as well as in the case of information systems, have been focused on acquiring data regarding changes within enterprises using various "external" methods, which can be considered to be based on the empirical approach. Persons participating in changes are interviewed, questionnaires are issued and the researchers review the collected documents (Pettigrew 1990; Preston 1997, pp. 30–32). However, this has proven to be insufficient in understanding complex change processes. Within the framework of action research, new methods of

various degrees have been created, meaning that the researchers participate closely in the change processes and also affect them (Argyris & Schön 1978; Gustavsen 1985; Westbrook 1995; Bruce & Wyman 1998).

In the field of action research, *constructive research approaches* have been developed and applied in organizational change studies (Hutchel & Molet 1986; Kasanen et al. 1993; Lukka 2000; Heckscher et al. 2003; van Aken 2004). According to this approach, in cooperation projects, researchers participate actively in the analysis of the current situation, the planning of the changes and the testing and stabilization of new activity modes and practices. In this study, the research-aided development model is developed and analyzed.

The relationship between research and practice is readjusted in constructive research so that the relationship is immediate and fixed. Research and practical development work are concurrent and interspersed with each other. This sets some special requirements for the research design and the researchers' activities (Engeström 1987 and 1999; Habermas 2003, pp. 15–17; Lukka 2000; Hyötyläinen 1988 and 2000). In constructive research, one must emphasize, aside from the issues pertaining to the research design, information acquisition, in order to promote the research activities. The foundation is finding relevant research objects and formulating research problems. Conducting research requires breaking down the research problems into research questions for which one can find answers through research, and the material collected within that framework. One significant question, by itself, is the issue of acquiring sufficient material. As well, there are many ways to acquire material for constructive research (Lukka 2000).

4.4.2 Defining research object and objectives

The definition of *research object and research problems* is an essential part of the constructive research and development process, as well as part of research in general (Strauss & Corbin 1998). The definition of research problems constitutes the central stage of research. A well-formulated problem is the absolute requirement for successful research activity. The research problems direct material acquisition and the selection of methods, as well as the analysis methods of the material.

On one hand, the definition of research objects and research problems occurs based on *the theory and the model world's concept models* and, on the other hand, in association with the development process, which is directed toward the real world (Sayer 1992; Stern 2003), as shown in the research and development model. The research problems must also be significant from the perspective of the *practical development needs* (Rescher 2000). At the same time, the research objects and research problems must be significant from the perspective of the research tradition pertaining to the object and its development mechanisms. From this perspective, the research problems are linked to the concept models and to their descriptions regarding the object's development mechanisms.

The definitions of research objects and research problems are closely dependent on the *research context* (Sayer 1992; Stern 2003). The research objects reflect the company's development objects and development goals. In this study, the context is the planning and implementation of information systems in organizations. The special object is the planning and implementation of the ERP systems, which are analyzed in the context of business activity system and its transformation process.

The objective can be viewed as creating in the user company applying the ERP system, a *learning and innovation environment*, where the organization and its actors are able to define their own needs and objectives, in the form of an information system concept, and are then able to efficiently take the information system into use and develop their activities and the system while using it (MacDonald 1998, pp. 40–43; Hyötyläinen 1998; Norros 2003 and 2004; Pahl 2004).

The perspective here is *the social and organizational activity and learning processes* in connection with the implementation of the ERP systems (Clark & Starkey 1988; Garvin 1993; Feeney & Willcocks 1999; Lowendahl & Haanes 1997; Vicari & Troilo 1998; Dalcher 2003). The planning and implementation of information systems can be considered as a social process in which the various actors participate and influence the development of the ERP system and the activities. The roles, orientations, interests, and interactions of the actors affect the formation of solutions (Nonaka & Takeuchi 1995; Dixon 1999 and 2000).

4.4.3 The definition of research problems

From this basis, the following *research problems* can appear, hypothetically seen, in connection with the object (Feeney & Willcocks 1999; Scarbrouggh 1999):

- In relation to the *requirement definitions*, how does one progress toward the implementation and use of the system?
- What is a typical *implementation process* of an ERP system in reality and, what are the central challenges and problems and how can they be overcome?
- How can one maintain the *knowledge* created during planning and implementation and how can one use it?
- How does one *organize the development during use*, and how does one support learning among people and organizations?

As one perspective could be, what kind of learning processes are enabled and supported by companies' new organization forms and activity modes (teams, networks, creation of activity processes, cooperative methods among companies) in the implementation of the ERP systems (Tushman & Nadler 1986; Clark & Starkey 1988; Garvin 1993; Sitkin 1996; Hyötyläinen 1998; Feeney & Willcocks 1999). Further questions could be, what effect do the adopted planning and implementation models have on the results from the implementation of the information systems, as well as on the personnel's work and activity modes; what planning and implementation models and methods produce the best results and can support the development of the personnel and the organization's knowledge (Checkland & Holwell 1998; Gottschalk 1999; Leem & Kim 2004).

The objective can be *the creation of new models and methods* in order to support the ERP system's implementation process and the organizational learning processes and the work development (Engeström 1994; Hyötyläinen 1998). The objective is to create and develop activity models and methods by means of which one can achieve better results and which support development of the personnel's learning and the further development of the systems.

As *a central theoretical question* in research could be, what is meant by the implementation of information systems as a developing social activity and learning process? The objective is to understand the ERP systems' planning and implementation process, as well as their development mechanisms. In particular, this means the description and analysis of the processes. From this basis interpretative models can be achieved (Glaser & Strauss 1967; Hartley 1994; von Wright 1971 and 1998; Turner 2003).

The above delineated research objects and research problems bring up a number of questions waiting for answers. Primarily these are associated with the development of the companies' resource planning, activity modes, and information systems, as well as supporting models, methods, and tools. It can be said that the processing of these issues and accumulation of more information about these issues, serves both the creation of theoretical concepts and models, as well as the companies' practical needs (Checkland & Holwell 1998; Avison & Fitzgerald 1999; Herrmann et al. 2004).

4.4.4 Forming research questions

The research subjects, with their associated research problems, determine the focus of the study. The research objects and research problems are defined in the framework formed by the theoretical concept models and the companies' development problems. However, the practical implementation of the research requires that the research problems be broken down into research questions for which answers are being sought through the research. Research questions are issues around which the acquisition of research material is wound. From this basis, one can analyze, respond to posed research questions and make theoretical generalizations (Yin 1994; Eisenhardt 1989; Hyötyläinen 1998 and 2000; Engeström 1987). For this reason, it is important to define the dimensions and factors included in the analysis. From the perspective of research and development activity, one must include all factors that are essentially associated with the change. Correspondingly, the research analysis requires from the material sufficient coverage, so that the theoretical conclusions are sufficiently well-founded (Pettigrew 1990; Lukka 2000). Below, we will first discuss the formation of research questions. This will be reviewed in connection with the planning and implementation, and use activity of the ERP system.

Based on the research problems that were presented in the previous chapter, we can, hypothetically, ask clarifying questions. The questions pertain to the activity and learning models in regard to the planning, implementation, and use of the ERP systems, as well as associated methods. The *research questions* can be as follows:

- What are the *stages* of the planning and implementation process?
- What are *the planning and implementation models* and methods that are used?
- What are the ERP systems' *implementation and use forms* in a company?
- What are the various *actors' roles, tasks and interactions* during the ERP systems' implementation process
- What kinds of *decisions* are made during the planning and implementation process and how are they made?
- How do we consider *the requirements set for users' work* on the implementation and how are they delineated?
- What is done for *development during use* and what organization means and methods are used?

The formulation of research questions and the response to research questions are linked to the research method. In this study, the analysis has focused on constructive research methods. In this connection, a central way to participate in companies' development processes is development group work (Bruce & Wyman 1998; Hyötyläinen 1998 and 2000). At the same time, development group work is a way to collect information about companies' development processes and development mechanisms, as well as the views of the actors. Other associated information acquisition methods are interviews, questionnaires, document analysis, the use of various information sources, as well as the preparation of studies and literature analysis (Silverman 1993; Cassell & Symon 1994; Strauss & Corbin 1998).

4.4.5 A hypothetical research and development framework and information acquisition

From the perspective of development activity, as well as the research's information acquisition method, it is important to make operational the planning, implementation, and operational environment of the ERP system. In Figure 7, we presented an organizational context model for the planning and implementation of the ERP system. From the perspective of the performance of research and development activity, it is necessary to create, based on an organizational context model, an operational model by means of which one can perform research information acquisition and development activity.

In Table 1, we present, from the perspective of the end-user company, a *hypothetical model framework* for the concurrent development of enterprise resource planning and activity mode, as well as its dimensions and associated factors. Within this framework, we will analyze the research's information acquisition methods, as well as the framework of the development activity (Hyötyläinen 2000). Next, we will analyze, based on the table, the object, the concurrent development of enterprise resource planning and activity modes.

4.4.6 Determining an analysis frame

The planning and implementation of the ERP system plays a central role in *the development of enterprise resource planning* (Hong & Kim 2002; Al-Mashari & Al-Midimigh 2003; Ho et al. 2004). The development of enterprise resource planning and activity modes is at the core of the research and development work (Checkland & Holwell 1998; Feeney & Willcocks 1999; Doherty et al. 2003; Dalcher & Genus 2003). However, one cannot understand the development of enterprise resource planning and activity modes without discussing three other dimensions (Hagström & Hedlung 1998; Hyötyläinen 2000; Pahl 2004). These dimensions are the *company's operational environment*, the *business activity's strategic conditions* and the *conditions for the development activity*. The development of enterprise resource planning and activity modes is based on, and is often also triggered by the enterprise's strategic prerequisites and business activity strategy. These, for their part, are closely tied to the company's operational environment and its development characteristics. Due to that, the

research and development work requires analysis of the company operational environment and analysis of the strategic preconditions ruling business activities (Earl 1999; Mintzberg 1994; Mintzberg et al. 1998) A decisive role in the development of enterprise resource planning and activity modes, as well as the development methods, is played by the company's prerequisites for the development activities (Nonaka & Takeuchi 1995; Dixon 1999). In research, one must also acquire information about the conditions for development work, because this explains the company's development mechanisms and the organization means, and the methods that the company has adopted.

Table 1. Simultaneous development of the enterprise resource planning and of the activity mode of the company and information acquisition methods for research.

COMPANY'S OPERATIONAL ENVIRONMENT	**STRATEGIC BASIS FOR BUSINESS ACTIVITIES**	**DEVELOPMENT OF ENTERPRISE RESOURCE PLANNING**	**BASIS FOR DEVELOPMENT ACTIVITY**
LINE OF BUSINESS AND ITS CHARAC-TERISTICS Nature of the line of business and its development characteristics Competitors The company's development stages and activity models The company's competition factors *Information acquisition methods* Information sources Interviews	BUSINESS ACTIVITY STRATEGY Vision and objectives Company's business principles Development programs and development activities *Information acquisition methods* Interviews Documents Strategy work	OBJECTIVES Control objectives The functional objectives The development objectives The work content development objectives *Information acquisition methods* Documents Interviews Development group work	KEY PERSONNEL EXPERTISE Personal history Task descriptions Know how Development motive *Information acquisition methods* Interviews Questionnaires Development group work
CUSTOMERS AND REQUIREMENTS Customer groups Nature of the customer's business Customer requirements *Information acquisition methods* Interviews Development group work	ACTIVITY PROCESSES OF RESOURCE PLANNING Objectives Activity processes Information flows Organization model *Information acquisition methods* Interviews Modeling Development group work	COOPERATION MODEL Tasks and roles Work processes Cooperation methods *Information acquisition methods* Interviews Documents Modeling Development group work	DEVELOPMENT ACTIVITY Development activity method Development activity organization *Information acquisition methods* Interviews Development group work
IT-DEVELOPMENT AND POSSIBILITIES CREATED BY IT IT-development characteristics New possibilities Applicability of the solutions *Information acquisition methods* Information sources Interviews, Studies	INFORMATION MANAGEMENT STRATEGY Objectives Resources Activity mode Information security *Information acquisition methods* Interviews Modeling	ERP SYSTEM IMPLEMENTATION Stages Tasks Organization Usability *Information acquisition methods* Interviews Documents Use analysis Development group work	IMPLEMENTATION AND DEVELOPMENT METHODS Models Methods Tools *Information acquisition methods* Interviews Development group work
		ACTIVITY MEASURING Indicators and meters Activity results *Information acquisiton methods* Development work Evaluation	

4.4.7 Defining a description and information pattern

The dimension of **the development of enterprise resource planning** has three parts, which, in the table, have been broken down into factors that can be controlled in the research. The information acquisition methods have been linked to these factors. The first and most fundamental part is an important starting point for the research and the development activity, i.e., the *objectives set on the enterprise resource planning* (Checkland & Holwell 1998). Here we can separate the following content objectives:

- The control objectives
- The functional objectives
- The development objectives
- The work content development objectives.

Information about these matters can be acquired by means of document analysis, interviews and development group work. During development activities, the objectives can be stated as formal descriptions, so they can be handled jointly within the company's various functions and actors, as well as in the following stages of the development process (Engeström 1994; Hyötyläinen 1998).

The second part pertains to the *enterprise resource planning cooperation models* (Kuutti 1994 and 1999). These can be:

- The task descriptions and actor roles associated with the organization, in particular, the resource planning
- Work processes
- Cooperation methods.

For these, one can obtain information from interviews, document analysis, modeling and development group work. For the needs of the development activities, one must create formal descriptions and models, so that one can handle change factors as part of the development process (Torvinen 1999; Hyötyläinen 1998).

The third part is *the information system and its implementation* (Hyötyläinen 1998; Simons & Hyötyläinen 2001). In the development of enterprise resource planning, a central role is played by the implementation and use of the enterprise resource planning system. From the perspective of the research and the development work, one can choose, as a central focus, the implementation and use methods. The organization has its own method of implementing and using the ERP system. The issues analyzed, can be as follows:

- The stages of the planning and implementation process
- The tasks to be performed
- The planning, implementation and use organization
- The system's use and usability.

The ways of acquiring information are interviews, document analysis, use analysis and development group work. During the course of the development process, the enterprise resource planning system's requirement definitions and functional descriptions create the foundation for the selection and implementation of a system (Avison & Fitzgerald 1999; Browne & Ramesh 2002; Chiu 2004; Pahl 2004).

One can *monitor and measure* the success of the activity system and its control, as well as the implementation of the information system. The performance and the success of the development work can be evaluated based on various indicators (Farbey et al. 1999; Irani 2002; Gallivan et al. 2003; Leem & Kim 2004) . Here one can identify the following issues:

- The indicators and meters by means of which one evaluates the activity and its development
- The results of the activity
- The evaluation of the development work.

The development of indicators and meters can be part of the research and development activity. Changing resource planning and the implementation of the ERP system may require the development of new indicators and meters. By means of the ERP system, it is possible to produce new types of information and

reports. One part of the study can involve different questionnaires targeting the organization's personnel by means of which one can evaluate how well the development work has succeeded and the personnel's relationship to the development project (Gallivan et al. 2003).

The development of enterprise resource planning and activity modes cannot be reviewed separately from the enterprise's activities or from ***the strategic basis ruling the business activities,*** which are a central dimension from the perspective of the company's orientation and management (Earl 1999; Galliers & Swan 1999). The *business activity strategy* could include:

- A company's vision and objectives
- A company's business principles
- A company's ongoing development programs and development activities.

One can acquire information about these through interviews and document analysis. One part of the research and development activities can be participation in strategy work through which one forms a company's strategic choices and business strategy (Porter 1996). The result of this can be a documented strategy with associated strategy and analysis report (Hyötyläinen 2000). A strategic work can form the foundation and basis of the setting of development objectives for enterprise resource planning.

A central change factor consists of *activity processes* associated with resource planning (Davenport 1993; Holtham 1994). These form an essential part of the enterprise resource planning and its development. At the same time, the development of the activity processes of enterprise resource planning and the organization development are intertwined with the company's business strategy and its implementation. The following factors are related to this issue:

- The objectives set for the activity processes and the organizations
- The activity processes
- The information flows
- The organization and the organization structures.

Regarding these issues, one can acquire information through interviews and development group work. In connection with development work, it is necessary to create models regarding the activity processes and information flow (Engeström 1994; Hyötyläinen 1998). The models and methods serve the planning and implementation of the changes within the development process.

Within the company, the definitions and implementation of the ERP system can also be based on conscious *information management strategy*. This can be prepared pertaining to the company strategy (Earl 1999; Cassidy 1998). Information management strategy may involve the following factors:

- Objectives of information management
- Available and necessary resources
- Activity modes that are being adopted and developed
- Information security issues.

Regarding this, one can obtain information through interviews and document analysis. As part of the strategic work, the preparation of information management strategy can be part of the research and development activity. Thus, it would be necessary to create a model of information management and its dimensions (Hyötyläinen 2000).

From the perspective of a company's activity and business strategy, the ***company's operational environment*** is of significant importance, which is an important dimension for business activities. Here *the line of business and its characteristics* have a central role (Hyötyläinen 2000; Womack & Jones 1990; McGahan 2004). This can be described using the following factors:

- The nature of the line of business
- The development characteristics of the line of business
- The company's competitors
- The company's development stages and activity model
- The company's competition factors.

Regarding these, one can collect information from various information sources and through interviews. As well, the company's key personnel can produce material regarding this. If, during the study, the researchers participate in the company's strategy work, one part could be the analysis of the operational environment and its development characteristics, where one could use the line of business knowledge that can be found within the company (Alasoini et al. 1994; Hyötyläinen 1998 and 2000).

Customers and customer requirements are closely associated with the line of business and the company's activities (Hyötyläinen et al. 1999). This forms the foundation for the development of the company's activities and strategy. The following factors are related to customers:

- The company's customer groups
- The nature of the customer's business activities
- The customer's requirements.

Regarding these matters, one can collect information through interviews and development group work. One possibility is that, for the sake of research and development activity needs, one makes visits to customers and does charting of their requirements (Hyötyläinen et al. 1999).

In the background for the information management strategy and for the definition of the ERP system, can be found *information technology development and the possibilities it opens* (Laudon & Laudon 2000; Currie 2000). In this regard, it may be necessary to acquire information for the needs of the research and, in particular, the development activities. The following issues could be considered:

- the development characteristics of information technology
- new possibilities
- the applicability of the solutions.

Regarding these issues, one can acquire information from various information sources, interviews and by preparing studies and literature reviews.

The enterprise's resource planning and the development of its activity modes and the associated procedures are centrally connected to ***the company's development activity*** level and its procedures (Winter 1996; Felman 2000). These form the essential conditions for the change process of the enterprise resource planning and activity modes. The basis is formed by the expertise of key personnel. *The expertise and commitment of the key personnel* are deciding factors in the success of the change process. This is described by the following factors:

- the personal history of the experts
- the job descriptions
- knowledge
- development motivation.

Regarding this, one can obtain information through interviews, questionnaires and development group work.

The *development activity* within the company is described by the manner of *development work and its organization*. Closely related to the manner of development activity are the adopted procedures and method use, as well as their use in various connections (Toikka et al. 1996; Nokaka & Takeuchi 1995; Winter 1996; Hyötyläinen 1998 and 2000). The used implementation and development methods affect decisions regarding the ERP system and its implementation and use. The implementation and use of the ERP system can be supported by means of various *models and methods* (Engeström 1994; Sitkin 1996; Preskill & Torres 1999). These could be:

- models describing the development objects
- various methods that promote definitions and development activity
- tools supporting the use of methods.

Information regarding this can be acquired through interviews and development group work. In connection with the research and development work, it may be necessary to create and develop these methods. These methods may be needed for system definition, planning, implementation and use (Vicente 1999; Torvinen 1999; Hyötyläinen 1998).

4.4.8 Analysis pattern

Above we have described the study issues and information acquisition methods, based on the constructive model, which pertain to research questions and also to research and development activity, as well as discussed the development dimensions for the business activities. According to this, during the research and development process, a vast amount of multifaceted material can be collected (Engeström 1987; Alasoini et al. 1994, Hyötyläinen 1998; Lukka 2000, Heckscher et al. 2003). The collected material allows us to describe and analyze the object and change process. Based on this, one can answer the questions posed by research and reach theoretical conclusions. *The first task is to understand the development of enterprise resource planning and activity modes, as well as the planning and implementation process of the ERP system, and the development mechanisms involved.* In particular, this means the description and analysis of the processes, included the operational context and strategic issues. *Second, due to the constructive model, the intervention and its process as well as methods can be described and analyzed* (Engeström 1987 and 1999; Fryer & Feather 1994; Heckscher et al. 2003). Through the descriptions and analyses, it is possible theoretically *to interpret the development process and to create interpretative models of the object and its development* (Yin 1994; Eisenhardt 1989; Hyötyläinen 1998 and 2000; Lukka 2000).

4.4.9 Concluding remarks

The object, in the chapter, is the researching model for the planning and implementation process of information systems, and, thus, the treatment as such, is related to the issues of research programs concerning the planning and implementation of information systems (Lee 1999; O'Donovan & Roode 2002; Al-Mashari 2003). A significant primary purpose is to discuss the formation of the research design and associated organization of information acquisition. This analysis is performed in the context of constructive research approch (Lukka 2000; van Aken 2004).

The significance of this chapter is twofold. First we have the fact that in the research the conceptualization of the planning and implementation activities of the ERP systems is linked to the research and development model and, through

that, to scientific approaches (Lee 1999; Checkland & Holwell 1998). The second point in the chapter consists of the research design and the methodological and methodic results related to the information acquisition. These are linked to the creation of the research problems, the research questions, as well as the development model framework, which has been put into the table form. In this scope, we are reviewing and analyzing the research's information acquisition methods, as well as the framework of the development activities. This is done in the context formed by the planning and implementation of the ERP systems (cf. Checkland & Holwell 1998; Iivari & Lyytinen 1999).

The analysis and modeling in the chapter can also be seen as being significant from the perspective of the practical company projects, because it produces generalized knowledge and new views for the conceptualization of the planning and implementation phenomena concerning ERP systems. The created organizational context model, earlier in this study (Figure 7), and, based on this, the developed analysis and development framework presented in the table form serve the conceptualization and determining of the dimensions, which are relevant for developing enterprise resource planning systems in an organization. The viewpoint is the concurrent development of the enterprise resource planning and of activity mode of the company (Doherty et al. 2003; Bai & Lee 2003; Simons & Hyötyläinen 2001). However, three other dimensions are essential to take into account when developing the enterprise resource systems in the company. First, the development enterprise resource planning and activity modes have to be connected to the company's strategic prerequisites and business strategy. Second, the development work requires the analysis of company operational environment and the analysis of the strategic conditions ruling business activities. Finally, a decive role in the development of enterprise resource planning and activity modes, as well as the development methods, is playd by the company's way for the development activities (Winter 1996; Pahl 2004).

5. Conclusion

In the conclusion chapter of this study, we will summarize the study and evaluate the study results. The basic problem in this study is what is the relationship between practical development and research, and how to solve and organize this relationship. We discerned five reserch questions of which two questions are based on the theoretical analysis of scientific research approaches, and three questions concern the subject phenomena of the planning and implementation process of information systems. First, the summary of the study and it results will presented. Second, the study results will be handled according to the background of five research questions. In this connection, we will discuss the research and development models that were created during the study, as well as their extension and further details. Here we will also summarize the results of the study's practical object, the information systems' planning and implementation process, the review and analysis. This discussion will focus on the analysis of the creation of the research design and the data acquisition methods. The primary results pertain to the planning, implementation and use of ERP systems. Third, we will evaluate the study results and their status in the research tradition in question. Finally we will discuss the need for further research.

5.1 Summary of the study

In this study, we pose the question of practical interests in theory formation. The starting point is the development of such methodological concepts, models and methods by means of which, in practical research work, one can proceed in the area between research and practical development. The foundation is formed by the view held by pragmatic philosophical tradition and concept of knowledge in regard to which the relationship between research and practice is formulated as tight. According to this, there is a strong interactive relationship between research and practical information acquisition. The perspective here is the functionality of research and information acquisition. The criterion for knowledge is purposeful activity and practice (Rescher 2000; see von Wright 1998).

The research task is approached in two different ways. The starting point is ***the theoretical analysis***, which is focused on the scientific research approaches and

methods. The following research approaches are discussed: positivism, interpretavism, action research and the constructive approach and, as well as the realist approach. Through these research approaches, we ended up with two scientific approaches by means of which the relationship between research and practice can be aligned differently. These are the constructive approach and the realist approach. In both of these, a clear distinction from positivism is made. The starting point is the reversal of the relationship between theory and observation. The theories form the determining foundation, and observations are tied to theory. In addition, research is considered a social activity. Here a dual hermeneutic is working. The researchers form a social community and the research object is a social community. To a great extent, both communities share the same significance. What is essential here is that both the researcher community and the community that is the subject of the research have a relationship to the material world. The practical knowledge of the community, which is the object of the study, is reflected in the real world. Here, the main argument is that knowledge is context-dependent and tied to human activity and communication (Sayer 1992). For this reason, the reality criterion of research results is practice.

Based on the approach of constructive methods and the realist approach, *a research and development model* is created, where the central point is a research-aided development process. With the help of this model, one can emphasize the link between research and practice, as well as the possibilities of transcending this link. In the model, we differentiate between the model world and the real world, and we discuss their relationship. The model world consists, by nature, of a concept system, which describes actors, objects and relationships. In the real world, we have real actors, objects and relationships, as well as development processes. The foundation of the model world is made up of concept models, which form the basic parts of the theory. Based on the concept models, research objects and research problems are built. These reflect and mirror the real world's development objects and objectives. At the same time, the solution models and methods, which are born within research, and research and development processes, have a relationship to the solutions that pertain to products, technologies and organizations, and are created and developed in connection with real development processes.

An essential part of the research and development model is the *research-aided development process*. It falls in the area between the model world and the real world. Research-aided development is fundamentally part of the model world. However, part of it belongs to the real world. Research-aided development process is linked to the real world's development objects and development activities and it participates with the actors in the planning, testing and stabilization of development activities.

Separately, as its own entity, we analyze the research-aided development model. As an application, we analyze experimental development research, which was developed at VTT Industrial Systems, and its methods and development cycle, which play a central role in combining practical development activity and research activity. Experimental development research can be considered as research strategy by means of which we answer the questions how and why (Yin 1994; Engeström 1987). How refers to how practical solutions are created and are made functional. Why refers to conceptual and theoretical questions. Experimental developmental research is linked to practical development work, but we are orientating ourselves in this direction by means of conceptual concept models. In this regard, we will discuss results and their interpretation. Here, we can separate four ways to interpret research results (Heckscher et al. 2003, pp. 107–142; Lukka 2000). These are a description of the object activity system and its change process; a description of the practical development activities that are part of the research; the understanding of the functioning of the activity system, its development and development mechanisms, as well as the interpretation of the change and development processes of the object activity system and its development mechanisms; and the creation of explanation models.

The research and development model that is created in this study, including the clarified research-aided development model, and the experimental development research method, forms the basis in analyzing this study's methodological framework and ***practical object***. The research and development model is used in forming the model for researching information systems. The model requires to understanding the phenomena of the research object and its development mechamisms. In this study, the practical research object is *the planning and implementation process of information systems,* and especially the ERP systems.

The two dimensions were distinguished, pertaining the phenomenon being researched. First one is the implementation of technical and organizational change. The second one is planning models and approaches through which an information system is planned. These dimensions have of a great importance for research activity and the forming of a research model, as well as the research design.

The two primary models are developed through the analysis of the phenomenon of the practical research object. In the case of the implementation of the technical and organizational change, *the interation and learning model* for the planning and implementation of information systems, is developed. The model brings out the need the use of information and knowledge in business activities and their development where learning and innovation steps are as fundamental elements for the implementation of information systems. The dialogue process is also shown an essential factor for the realization of the information system and for building knowledge base in the organization. Another model, in the case of planning models and approaches, is *the use-oriented planning model*, with its five dimensions, is developed and analyzed in this study. It is shown, in this study, that the model facialites the learning and innovations processes associated with the planning, implementation and use of information systems.

Based on the model for researching information systems, as well as for the created and developed two models concerning the practical subject of this study, ***the hypothetical model for researching information systems*** is developed and analyzed. The model is based on using the constructive research approach, where the development group work is an important means to acquire information about ongoing processes, as well as for researchers to participate in the development processes.

Within the area of the planning and implementation of the ERP system, the research object and objectives are, in principal, defined. Based on this, the research problems are outlined. The research problems are, further, divided, hypothetically, into the research questions. In this study, the research problems and questions, as well as information acquisition methods, are analyzed through the research and development framework, which is put into the table form. In this context, the dimensions of the planning and implementation of the ERP system are analyzed, as well as information acquisition methods are described, and they are connected to these dimensions and their different parts. The main

dimensions essential for the planning and implementation of the ERP system are the company's operational environment, the strategic basis for business activities, the development of the enterprise resource planning, and the basis for the development activity.

5.2 Research questions and study results

In this study, the basic question concerns the possiblity of transcending the relationship between practical development and research. This basic question is divided into the five research questions. Two of them are linked to scientific research approaches and study models, as well as research activity and conceptual worlds. The rest, three research questions, concern the study and application models of information systems. In the following, each question is considered through the study results.

5.2.1 Relationship between research and practical activities

The first research question is answered through the theoretical analysis of research approaches and study models. The first research question, in this study, is:

- *How is the real world viewed and how is the relationship between research and practical activities viewed by various scientific approach methods?*

The second research question is more oriented to the research models, which are developed in this study. The base model developed is the research and development model. Based on this, the reseach-based development model is analyzed. The second research question is:

- *What effect does research-aided development have on practical research and its interpretation and where is the experimental design in the field of research and practical development activity?*

To answer to these questions and to find the appropriate theoretical and methodological grounds for constructive approaches, and, in particular, the research-aided development model, the theoretical analysis of research

approaches is made. For this, the following research approaches and study models are discussed and analyzed: positivism, interpretavism, action research and the constructive approach, as well as realist approaches. In Table 2, we present and compare these research approaches and study models with each other through ten dimensions.

Table 2. The comparison of scientific research approaches and study models.

	Positivism	**Interpretativism**	**Action research**	**Constructive approach**	**Realist approach**
Scientific Roots	Scientific research concepts	Hermeneutics, Phenomenology	Critical social theory, Lewin's change experiments	Action research, Development approaches	Realist approaches, Knowledge concepts
Study approach	Empirical approach	Understanding approach	Change and participative approach	Systemic and development approach	Approach for grounds and truth of knowledge
Research activity view	Cool outside observering	Study as social activity	Process consulting	Process consulting and research based development	Knowledge production as social activity
Object viewpoint	Empirical facts	Actors' mental models	Change processes and practices	Analysis and solution concepts and models	The distinction of thought and real objects
Prime study Objective	Hypotheses	Theory formation	Involvement to social activity	Experimenting new solutions and knowledge	Development mechanisms
Information acquisition approach	Catching facts	Observation tied theory and understanding process	Incremental development cycle and develoment actions	Change experiments and development actions	Literature and practice review
Analysis method	Testing	Reconstructing situations	Data and information analysis	Information and knowledge analysis	Theoretical and practical analysis
Knowledge concept	Generalizations	Context bounded know-how	The great role of practical knowledge, based on case study	The fusion of development and research knowledge	The emphasis on context-dependency and practical adequacy of knowledge
Theory model	Theory building, Explanation models	Finalist interpretation models	Grounded theory models	Interpretation and understanding models	Theory-laden conceptualization of information
Research method	Observation	Observation	Participating methods Observation	Participating methods Constructive methods Observation	Concept development methods

From the point of view of research-aided development and "practice theory" (Stern 2003), the constructive model and the realist approach offer the best starting points and methods for the research and development model, developed in this study, and a means to the conceptualization of the foundations of knowledge for the purpose of the constructive approach. The constructive model is close to the tradition of action research, but it takes more systematic view on the activity system under study (Lukka 2000; van Aken 2004; Hyötyläinen 1998). Action research is more oriented to process consulting, and participating in change processes (Argyris & Schön 1978; Bruce & Wyman 1988; Schein 1987). The constructive model is also connected to process consulting, but it emphasizes, at the same time, research-based development activity. In the constructive model, the main object viewpoint consists of the analysis and solution concepts and models. In action research, as a main point can be seen to be the involment in social activity and its change processes. The model of theory in action research can be regarded as being based on grounded theory models (Glaser & Strauss 1967). This means that practical study and practical knowledge are as a great role in the knowledge concept of action research.

In the following, we will analyze more deeply the scientific research models and their dimensions, from the point of view of the two models developed in this study. The first model is *the research and development model* (see Figure 3). The development of this model is mainly based on the following elements:

- The base is the distinction between thought objects and real objects made by the realist approach (Sayer 1992). On this ground, the model world and the real world are distinguished in the model. The main elements in the model world are: concept models, research objects and problems, and solution models and methods. All the concepts and models are describing the real world's subjects and characteristics. As such, the knowledge concept adapted in the research and development model, is based on the emphasis of context-dependency and practical adequacy of knowledge, as presented in the realist approach. In the connection of the treatment of the concept models, the mental models of actors are also emphasized, according to the interpretative model (Weick 1995).
- The second element is research-aided development process (Alasoini 1999; Heckscher et al. 2003; van Aken 1994). It can be seen that this is based on

some elements of action research and constructive approaches. Change and participative approach is adapted from action research, and systemic and development approach from the constructive model. In addition, the development cycle presented in the model, can be seen to be based on the grounds of incremental development cycle and development, involved in action research (Bruce & Wyman 1998).

The second model, developed in the first part of this study, concerns *experimental development research and its development cycle* (see Figure 5). Experimental developmental research and its concepts are based on the extensive and intensive research and development work, carried out through many projects (Toikka et al. 1988; Norros et al. 1988; Alasoini et al. 1994; Hyötyläinen 1988 and 2000; Kuitunen et al. 2003; Hyötyläinen et al. 2004; Mikkola et al. 2004; see Engeström 1987 and 1999). At the same time, experimental development research and its development cycle have theoretical and methodological roots concerning scientific research approaches. In the following, these scientific roots will be handled:

- The first feature is case study research (Yin 1994). This is a typical characteristic of action research. In constructive model, case studies also are the normal starting point to the study (Lukka 2000; van Aken 2004). Knowledge concept, in this case, is, partly, based on grounded theory approach (Glaser & Strauss 1967; Hyötyläinen 2000, pp. 115–117), typical to action research, and, partly, on the fusion of development and research knowledge, according to the constructive model. At large, the knowledge concept of experimental development research resembles the realist approach with its emphasis on context-dependency and practical adequacy of knowledge (Sayer 1992).
- The development cycle of experimental development research is near to the nature of incremental development cycle of action research (Bruce & Wyman 1998; Hyötyläinen 2000, pp. 115–117). However, some features are of special nature, in the case of exerimental develoment research. The first is that reasearch stages are congruent with and tightly connected to the focus organization's change process, the main phases being: present activity mode, problems and development needs; planning and experimenting the new activity mode; and stabilizing the new activity mode (Engeström 1987). The

second feature is the continuous cooperation with the actors in the focus organization. The third characteristic is the great emphasis on experimentation phase as a crucial study phase (van Aken 2004). This is grounded on the constructive model, but action research has some similar features, in particular, Lewin's change experiments (Bruce & Wyman 1998). The fourth point is the central position posed into the use of tools and methods in the connection with research and development process. The main aim is that the planned and experimented action modes as well as the used methods will become as part of the normal activity of the focal organization (Hyötyläinen 1988 and 2000).

- The particular feature in experimental development research is the hypotheses formation and "testing" (Engeström 1987). In the positivistic model, the forming of hypotheses and their testing against the gathered facts are a typical pattern. Positivistic model aims at generalizations and causal laws, like natural sciences (von Wright 1971; Chalmers 1999; Rosenberg 2005). The role of hypotheses in experimental developmental research is different than in the traditional positivistic model. The analysis and development of solution models occurs in the form of clarifying hypotheses, which are used as a research method in processing research material and case study results. At the same time, the formed hypotheses act as research tools and a means to direct the case study, as well as the development of actions in practice (Lukka 2000).

5.2.2 Study models of the implementation of information systems

As an application object, we are discussing the planning, implementation and use activities of information systems and ERP systems, in particular. The research and development model that is created in this study, including the clarified research-aided development model, and the experimental development research method, forms the basis in analyzing this study's methodological framework for practical object. The application object is viewed from research and information acquisition methodological perspectives. However, to understand the application object, it is necessary to describe and analyze the object, the planning and implementation process of information systems. First, we will consider the *model for researching information systems* (see Figure 6).

- The researching model is based on the grounds of the methodological studies concerning information system (Lee 1999; Checkland & Hollwell 1998; Al-Mashari 2003), as well as the research-aided development model, developed in this study.

Three research questions are connected to the application object. The first one is:

- *What kind of phenomena pertain to the application of information systems in an organization, and what perspectives and development dimensions determine the implementation process?*

The treatment of the subject shows that we have the good picture of the phenomenon of the implementation of information system in this study. The grounds of the models are discussed in the following:

- The organizational context model is created for this study. The phase model and the process model are based, partly, on the former research (Hyötyläinen 1998; Kettunen & Simons 2001; Simons & Hyötyläinen 2001) and the development made for this stydy. The activity model for implementation are, partly, based on the former study (Hyötyläinen 2000). The base of the interaction and learning model for the planning and implementation of information systems, is, mainly, in the former research (Kettunen & Simons 2001; Simons & Hyötyläinen 2001). This is the central model concerning the implementation. The dialogue model, developed for this study, supplements the interaction and learning model.

In the following, we will describe and handle the second research question pertaining to the planning of information systems. The question is:

- *Which planning models can be used to support the learning and innovation processes that occur in connection with the planning, implementation and use of information systems?*

The use-oriented planning model is created in this study. The created model progresses the learning and innovation processes in the connection of planning, as shown in this study. At the same time, the model contributes to learning in the

implementation and use phases. The bases of the model will be handled in the following:

- The model is presented first time. The original outline of the model is presented in the former study (Hyötyläinen 1993; see also Hyötyläinen et al. 1990). The model is further developed for this study. The ground is also other studies (Norros 2003; Dittrich & Lindeberg 2004). The extension to the role of users, is made for this study.

The hypothetical model for researching information systems is formulated as a logical extension of the created former models, research-aided development model, as well as the application models, in particular, organizational context model (Figure 7) and the interaction and learning model (Figure 11). The research question, concerning the hypothetical research model, is:

- *How do we gather information about planning and implementation processes, and what kind of concept models and methods do we have at our disposal for information acquisition and for formulating new concepts?*

There are some new features that are developed for the hypothetical researching model, compared with the models created and handled in the first part of this study. All in all, the analysis of the model shows that we have created an approriate model for analyzing the formation of research design in the area of the planning and implementation of information systems, and, in particular, ERP systems. In the following, some further points are explicated:

- The main point in the hypothetical model for researching information systems, is the created method, with the concrete examples, that define how to form the research design, including the definition of research object, research problems, research questions and information acquisition, in the context of the contructive research approach and research-aided development model, in particular.
- The hypothetical research and development framework is created. The framework is also presented in the table form in which the main dimensions and elements concerning the development wholeness of the enterprise resource planning, with the aim to implement a new information system. At

the same time, it is classified and defined information acquisition methods, placed into the different dimensions and elements in the table.

- The special treatment is focused to defining a description and information pattern. An essential feature of this treatment is the emphasis laid on the tight interaction between the research activities, with its information acquisition methods, and development activities carried out in practice. That is, the researchers are as active actors in the focus organization: iniatiating, planning, experimenting and maintaining the change processes in practice. In this, the central method is development group work, which is, at the same time, a means to progress and support the change processes in practice, as well as to acquire information from the same processes for the purpose of the study (Engeström 1987, pp. 321–337, Lukka 2000; Hyötyläinen 1988; Henriksen et al. 2004).

5.3 Evaluation of study results

The study and information acquisition questions regarding management, as well as social science research have been subject to extensive interest (see, e.g., Trist 1981; Gustavsen 1985; Yin 1994; Eisenhardt 1989; Pettigrew 1990; Easterby-Smith et al. 1991; Hamel et al. 1993; Silverman 1993; Cassell & Symon 1994; Hartley 1994; Ghauri et al. 1995; Westbrook 1995; Bruce & Wyman 1998; Strauss & Corbin 1998; Gomm et al. 2000; Alvesson & Deetz 2000; Heckscher et al. 2003). Constructive approaches and methods are also become into discussion (Hutchel & Molet 1986; Engeström 1987; Kasanen et al. 1993, Lukka 2000; van Aken 2004).

Instead, there are not so many research efforts and studies concerning the philosophical and methodological grounds, in the management and social studies, connected to the real study and information acquisition questions, as well as to how to proceed in the research process (see, e.g., Sayer 1992; Rosenberg 1995; Turner & Roth 2003; Smith 2004a,b; Tsoukas 2005). In this literature, the main emphasis is, only, on the philosophical matters and methodological issues, from the broad point of view. In fact, the studies linked to philosophical and methodological points, and, at the same time, dealing with

the operative study questions and the formation of study design are almost totally lacking.

In this study, we are addressing the problem. We define as *the basic issue pertaining to the relationship between research and practical development and the possibility of transcending this line.* The issue pertains to practical interests in theory formation. The whole treatment and analysis, in this study, is anchored to the description and analysis of scientific research approaches and study models. Thus, the study is based on the philosophical and methodological bases of research. At the same time, it is analyzed the question on constructive approaches and their place in the scientific reseach fields.

Through the analysis and development of research-aided development model, as well as modeling its study processes, the view is on the research and development. By means of the analysis of various research approaches, we show the possibilities of the research-aided development process in producing practical solutions and forming new theoretical and conceptual knowledge. As an application object, we are discussing the planning, implementation and use activities of information systems and ERP systems, in particular. In this context, we created and analyzed the formation of research design and information acquisition patterns, at the same time, showing the connections between reseach and practical development actions in the focus organization.

Finally, it is a reason to note that, in this study, the three aspects and factors are to be abled to connect with each other. ***The first*** is the creation and development of *a research and development model*, founded on scientific approaches. This is associated with the development and analysis of *a research-aided development model*. ***Another part*** is the conceptualization of technical change. The object is the planning and implementation process of information systems. **The third**, in the study, consists of *the research design and the methodological and methodic results* related to the information acquisition, based on research and study models, in particular, the constuctive approach. These are linked to the creation of the research problems, the research questions, as well as *the development model framework*. As such, this study lays new grounds for further research efforts in the same field, as well as for practical studies, based on the research-aided development model and its methods.

5.4 Further research

The study delineates the need for further research. The first issue is the need for the deeper and more extensive theoretical analysis of research and information acquisition approaches. There is especially a need for thorough analysis of the pragmatic tradition and the evaluation of its significance in performing research. The second need is the deeper study of the activity concept and the activity theory, and connecting this to the context of the planning, implementation and use of the ERP systems (cf. Engeström 1987; Vygotsky 1978). The third issue is the further development of the concepts, modeling and methods involved in learning and innovation activities. An interesting issue is the microcosm of knowledge creation and learning processes, i.e., how the creation of new knowledge and the learning process occur by means of concrete activities in organizations and in cooperation between organizations (cf. Krogh et al. 1998; Aldrich 1999). The fourth issue is further processing of the study's conceptualized use-oriented planning model and its application in practical research and development activities (Norros 2003; Dittrich & Lindeberg 2004). Finally, the further development and operationalization of the development model framework, which was created within the study, with associated research activity models, development work and information acquisition methods, is needed. By means of the model framework, one can, on one hand, direct practical research and development activity, and on the other hand, use the model framework to analyze material produced by means of the concrete research and development activity (Kettunen & Simons 2001; Boedker & Gronbaek 1996; Dittrich & Lindeberg 2004).

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Title

Practical interests in theoretical consideration
Constructive methods in the study of the implementation of information systems

Abstract

In this study, the basic issue is the relationship between practical development and research. The objective is to use various research approaches to show the possibilities of a research-aided development process as a constructive research approach in the planning and implementation of practical development solutions, as well as in the formation of new theoretical and conceptual knowledge. The applications discussed are the planning, implementation and use of information systems and especially enterprise resource planning systems (ERP).

The research task must be approached by means of theoretical analysis, which is focused on scientific research approaches and methods. To examine and create new models in this study, the following research approaches are discussed: positivism, interpretavism, action research and a constructive approach, as well as realist approaches. Through the analysis of these research approach methods, we will arrive at two scientific methods by means of which the relationship between research and practice can be aligned in a new manner. These are a constructive approach and a realist approach. Based on these approaches, one can develop a research and development model in which a research-aided development process is central. With the help of this model, one can emphasize the link between research and practice, as well as the possibilities of transcending this link. As part of the treatment, the issues of research results and interpretation are considered.

The study will shed light on the relationship between research and practical applications from the perspective of a real example. This example pertains to technical change with associated research and development designs as well as research methods. As a technical change application, we will analyze the implementation of information systems within an organization. In doing so, we will concentrate on the planning and implementation process of information systems. We will view the planning, implementation and use of enterprise resource planning systems using concept models and their relationships. With the help of concept models, we will delineate the planning and implementation process and its dimensions.

Based on the analysis of the phenomena concerning the planning and implementation process of information systems, we will study and analyze the creation of a research design and of how to organize the associated information acquisition. In regard to the planning, implementation and use of the enterprise resource planning systems, we will determine a research object with associated conceptual research problems. However, the practical implementation of the research requires that the research problems be broken down into research questions for which the actual research will find answers. Furthermore, the research process includes the creation of a model framework for the concurrent development of enterprise resource planning and action methods, and this model's dimensions with associated factors must be defined. Within this framework, we must scrutinize the study's information acquisition methods as well as the scope of the development work. The central information acquisition method is development group work, which constitutes an essential part of research-aided development. Development group work is also a central method in the development process. Other information acquisition methods are interviews, questionnaires, document analysis, the use of various knowledge bases and the preparation of different types of studies, as well as literature and concept analysis.

Keywords

scientific research approaches, study models, interpretavism, action research, constructive model, realist approach, information systems, modelling, enterprise resource planning systems, theory formation, information acquisition methods, development methods

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In this study, the basic issue is the relationship between practical development and research, and possibility of transcending that relationship. The objective is to use various research approaches to show the possibilities of a research-aided development process as a constructive research approach in the planning and implementation of practical development solutions, as well as in the formation of new theoretical and conceptual knowledge. The goal is to develop such methodological concepts and models – as well as research methods – through which practical studies can be conducted in the area between research and practical development.

The applications discussed are the planning, implementation and use of information systems and especially enterprise resource planning systems (ERP). Based on the analysis of the phenomena concerning the planning and implementation process of information systems, we will study and analyze the creation of a research design and of how to organize the associated information acquisition. The research process includes the creation of a model framework for the concurrent development of enterprise resource planning and action methods, and this model's dimensions with associated factors must be defined. The central information acquisition method is development group work, which constitutes an essential part of research-aided development. At the same time, development group work is a central method in the development process.

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