Motivation Structure of End-User Application Developers in Organisational Learning

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Abstract

Information and knowledge have played the primary role in the success of knowledge intensive companies. Working contents including both the substance and tools used are increasingly based on innovation and the adoption of new technologies. The goal of the study is to analyse the motivation structure of end-user application developers (EUADers) from the view of organisational learning. We study the intention and behaviour of the EUADers as innovators from the subjectivist point of view. The focus is on their motivation, styles of learning, perceptions towards the organisation and computing, tools and working methods used.

The research is based on interviews of ten active EUADers who are supposed to present the pioneers of new innovations in organisations. The findings show that the EUAD activity is based both intrinsic and extrinsic motivations. The EUADers are interested in computing per se, but the activity will continue only if it is useful. The findings show that whatever the context and motivation is, they are committed and highly motivated.We found two patterns of adoptions in the process of EUAD activity: the (i) desire-driven pattern of adoption is mainly based on intrinsic and (ii) the requirements-driven on extrinsic motivation. We also found four groups of EUADers: the (i) inventors take the EUAD as a hobby, the (ii) utilitarian users take the EUAD as a tool to improve their actual work performance, (iii) the work enrichers want to make their work more interesting, and finally, (iv) the opportunity seekers are that type of EUADers for whom the activity plays an important role in their position in their workplace. The results also show that even if the EUADers do not seek IT professions, they still are driven to apply more and more IT related tasks, many of them ending up as IT professionals as well.

At the end of the study we analyse the organisational implications of the EUAD activity. Accordingly, we discuss the role of EUADers as change agents, knowledge creators as well as resources in developing core competencies. We also discuss the findings in the light of modern job design. The study suggests that the management should consider more intrinsic motivation and reserve the end-users more time to for learning and developing of working practices.

Keywords

end-user application development,
end-user computing,
innovation, motivation,
organisational learning,
learning organisation

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I dedicate this thesis to my great sons, Johannes and Elias. I would like to be like them, creative and hardworking.

Lahti, July 2002 Torsti Rantapuska

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1 Introduction

The invasion of the information society is one of the most fascinating trends of the 20th century. New innovations and knowledge play the primary role in business. This trend has also given to rise to the knowledge industry in the service sector. Capital in its traditional sense of land, equipment, raw material and real property has had to give way to the human resource in the form of "know how" or "knowledge" on corporate balance sheets. The value of human and financial resources is usually well recognised, but data and information require effective use in the enterprises as a resource (Levitin & Redman 1998). Information occupies the most significant role in the concept of "virtual organisations", where the whole organisation is seen as a web of separate, but more and more interdependent units, each acquiring, processing and exchanging information with other units inside and outside the company (Venkatraman & Henderson 1998).

This trend has its effect on the basic assumptions of managerial thinking too. In as much as knowledge is becoming a considerable factor of work, the companies have also to prepare for continuous change in the working contents and methods. The work of today consists, in addition to routine practices, also of adopting innovations: like tools and technologies, working practices, and views and ideas. In order to sustain the competitiveness, one has to adapt business strategies that support innovativeness, learning, and sharing and creating knowledge in the working place (Brown & Duguid 1991). The work, in the same manner as it should be productive and effective, should be prepared for productive learning too.

Learning in the working place occurs both on the individual and on the organisational level. The individuals learn from organisations as far as organisations learn from individuals. The learning has to be seen as an essential part or the work itself. Learning is actually social by nature where the knowledge, skills and attitudes are closely merged together (Engeström 1994). Moreover, learning should also be self-steered, creative, and autonomous (Walsh & Ungson 1991). The employees are also taken as autonomous actors and responsible for the productivity and development of their work.

This study deals with one special group of learners in an organisation: End-user application developers (EUADers). By "End-users" we mean persons, who "develop software applications in support of organisational tasks" (Brancheau & Brown 1993). There are many types of end-users with various kinds of interests and skills. We concentrate primarily on those people who are the most active i.e. who by computer usage are voluntary, continuously developing their working methods and tools.

The concept of "end-user computing" in the IS literature (Rockart & Flannery 1983, McLean 1989) originates from the 1980s. The main interest in those days was how to get the end-users to use the computers and how to support them. Nowadays, the situation in work places is different. The end-users have to adapt and use new software tools not giving it a choice. The EUC has become one part of the work itself. We take it as one important factor of the context of learning-intensive, knowledge creating work. Also the IS managers still consider it important (Brancheau et al. 1996).

According to our view, the expansion of knowledge work and fast changes in business and in task contents raise the need for creating applications for own use. The nature of work is changed more and more from its pre-planned and structured nature toward a reactive and unstructured direction. Drucker (1999) illustrates the task characteristics of the knowledge-worker using a slogan: "*What is the task*". The content of the task is always under change requiring continuous learning and innovation. The benefits of THE EUAD listed by Vijayaraman (1988) become then apparent especially when the task is specialised and complicated:

- application can be developed quickly and inexpensively
- it overcomes the shortage of application development personnel
- it eliminates the problem of information requirement determination by an "outsider"
- it enhances the understanding of the problem
- it allows the user to translate his or her expertise directly into application
- it increases learning, improves productivity, improves internal organisational effectiveness and reduces system development cost

Also the new methods of software development support this trend. The paradigm of software development is shifting towards an easier and a more user-friendly way where the end-users can use ready-made components and classes to 'wire up' new applications. Accordingly, the software packages contain useful options, which the advanced end-users can utilise. The existing application generators and object-oriented visual programming tools provide the qualified users to develop and modify applications easily and rapidly (Siemon & Wu 2001). The production of software is also shifting towards the production of more ready-made components than complete applications (Welke 1994). Even though there exist many risks (Duê 1992, Davis 1989, Alavi & Weiss 1989, Kettelhut 1991) and problems concerning quality (Cale 1994, Hassinen 1988), the application area is often so specialised that it is much more reasonable to let the end-users develop their own applications (Pliskin & Perez 1988, Vijayaraman 1988).

The earlier studies of end-user computing have mostly concentrated on the factors of computer acceptance and adoption in organisations. The perceived usefulness (Davis et al. 1989, Compeau & Higgins 1991, 1995, Thompson et al. 1998) and the perceived ease of use (Davis et al. 1989) are found to be the most significant factors in the in adoption of new computer technology. Also the attitude toward actual system use (Blili et al. 1998) contributes to the system usage.

The end-users are mainly categorised based on the types of tools used and their organisational tasks. Rockard and Flannery (1983) found six groups among EUs: non-programming end-users, command-level users, end-user programmers, functional support personnel, end-user computing support personnel, and DP-professionals. Rivard and Huff (1985) categorised their data based on the department or task where the technology was applied. Their categories were micro DP department users, staff analyst, and opportunity seekers.

The earlier research (Rogers 1995, Brancheau & Wetherbe 1990) has also analysed the adoption of new technology as a diffusion process in organisations. The people are different in the willingness to try out an innovation. The more innovative persons are also more willing to take the risk that the innovations always bear (Agarwal & Prasad 1998). According to the diffusion theory of innovations (Rogers 1995) the new innovations are adopted mainly through the most innovative persons. These people, called as pioneers, act as change agents (Markus & Benjamin 1996) for the organisation to adopt new technology. They act voluntarily and autonomously using also more likely inter-organisational communication channels in addition to the organisational channels (Brancheau & Wetherbe 1990).

The organisation researchers have increasingly put focus on the resources, capabilities and learning as a business resource and strategy (Conner & Prahalad 1996, Kogut & Zander 1996). In these theories, the knowledge is the essence of the resource-based perspectives (Barney 1991) and also the source of success and competition. Andreu and Ciborra (1996) have created a theory of how the core capabilities of the company can be developed in order to gain strategic advantage. In their theory, learning plays a very significant role. Learning is a business function that comes from the bottom up to the core capabilities through three loops. Firstly, the *routinisation loop* takes advantage of resources in work practices, secondly the *capability learning loop* develops the work practices into capabilities and finally, the *capabilities* are faced to the competitive environment and the most suitable of them (i.e. the ones which are valuable, rare, imperfectly imitable and the ones which have no strategically equivalent substitutes (Barney 1991)) are picked and used *as core capabilities.*

The EUAD as a learning-intensive activity may also contribute to the organisational learning. A lot of research has conducted to develop the theories of organisation as a learning entity (e.g. Nonaka 1994, Nonaka & Takeuchi 1995, Crossan et al. 1999, Cook & Brown 1999, Brown & Duguit 2001, Järvinen & Poikela 2001, Malhotra 1997). The key issues are the concept of knowledge, what forms the knowledge has, how the knowledge is stored in the organisation and finally how the new knowledge is created in organisational practise. What kind of knowledge the EUADers create and how it works in the organisation is an issue of discussion in this study as well.

It is commonly acknowledged that the knowledge has two forms: explicit and tacit. The explicit knowledge covers the traditional dimension of knowledge as a written or other transferable form. The tacit dimension of knowledge covers the invisible knowledge that cannot or is not yet put in the explicit form, but anyway it works more or less consciously in organisational actions. The knowledge is individual when it works in the head of an individual person facilitating a work that another person cannot do. The group or organisational dimension of knowledge covers the idea of shared knowledge among individuals acting as a group or performing "organisational routines".

The fundamental nature of knowledge creation has been discussed a lot. Nonaka (1994) developed a theory that is based in an idea about a circular process of knowledge conversion. According to Nonaka the tacit individual knowledge has to convert into explicit form in order to be able to discussed and combined into explicit organisational knowledge. In the internalisation process, the explicit organisational knowledge can be taught to the people in training sessions in order to make it work tacitly in the business practice and produce the output as organisational tacit knowledge. The later refinements of the theory (Cook & Brown 1999, Brown & Duguit 2001) stress the difference and separate nature of the four dimensions of knowledge. Both of the dimensions: tacit-explicit and individual-organisational are different forms of knowledge in which one form of knowledge cannot be replaced by another form or converted to another. These dimensions act simultaneously in the process where knowledge of one form is used as a *tool* to generate knowledge of another.

Not depending on the discussion all the researchers of organisational learning stress the importance of practise in the successful creation of organisational knowledge. The middle management has a very important role as 'knowledge producers' in energizing the practise. In order to support creativity the managers have to sustain autonomy, creative chaos, redundancy, requisite variety, love, care, trust and commitment (Nonaka et al. 2000). The middle management stays in front of the chaotic reality trying to break down the visionary ideas of the top management into concepts and images, which guide the knowledge creating process.

The social and tacit nature of the knowledge has been emphasised quite much in the recent information systems (IS) studies. Some ethnography-oriented researchers even state that operating knowledge also remains tacit. The formal organisational structures do not actually function in the way the managers intend them to work. The working social organisation has a life of its own, creating its world with all the social and cultural rules. For instance, Brown and Duguid (1991) have shown that the written form of company documents does not always meet the real working practice in technicians' everyday working life. The innovations in the organisation are not always organisationally planned (Heikkilä 1995, Brancheau & Wetherbe 1990). The acceptance of new technology is rather a process in which the end-users adopt the use of new technology from their peers than from managerial orders. Therefore we more likely look for social and psychological explanations of learning, knowledge creation and innovative behaviour than creating new corporate policy to organise and manage the behaviour of people.

However, information and knowledge as intellectual capital is still not, like the traditional resources, in the total control of the management. It is rather social and intangible asset by nature (Brooking & Motta 1996). New innovations will rise in the social context where the knowledge is shared and blended by creating new connections among different technologies (Hargadon & Sutton 1997). The information and knowledge reside in the control of the staff members themselves. The more the company is dependent on knowledge, the more its success resides in the behaviour of the workers. The organisation does not even always know or understand the nature and value of its intellectual capital (Brooking & Motta 1996). In the organisations of experts, the managers do not have the knowledge to control the contents of the work of their subordinates. This deep-seated social change affects the position of the individual in the organisations. One has to do his/her work efficiently and commit her/him self to the goals of the company of his his/her own accord. The working arrange-ments are changing towards group and team work. The development of communication and information systems also supports this trend in the form of networking and group work applications.

Most of the previous studies of end-user computing approach the phenomena from the point of view of non-programming end-users. One concern of these studies has been how the great majority of end-users could adopt the new technology that the company has invested in (Brancheau & Wetherbe 1990, Rogers 1995, Davis et al. 1989, Compeau & Higgins 1991, 1995). This study analyses the EUC as a method for supporting innovation and knowledge creation process in the organisation. The focus of the study is the very early stage of the innovations when it is at the hand of the pioneers. The end-user application developers (EUADers) are supposed to represent the people having the

highest motivation to act as knowledge creators of that kind. Because these people play the primary role, it is also important to know the personalities and motivation structure of those people. We also try to understand their *intentions and desires* in their working places.

This type of knowledge interest also needs a different research approach. Earlier research has mostly taken a positivist view to the phenomena. This indicates the position that one can get the most objectivistic view by conducting a survey. We take a subjectivist stance for the study. We think that in this kind of study that focuses on analysing the individuals as members of organisation could advance when taking an interpretative, subjectivist stance. When doing so, we may get a deeper understanding of the phenomena. We think that some hidden reasons and motives of people for the actions in an organisation need personal view and interpretation.

There are also examples that the dominance of positivist approaches will have to give way to interpretative and subjectivist research traditions. Generally, not depending on the scientific tradition IS science has increasingly begun to acquire psychological factors and theories to analyse user behaviour in information systems usage. (For instance: Social Cognitive Theory (Compeau & Higgins 1991), Computer Self Efficacy (Marakas et al. 1998), Intrinsic and Extrinsic Motivation (Teo et al. 1999), User Competence (Munro et al. 1997), etc.).

The interpretative research tradition is now quite well introduced also in Information Systems Research literature (See e.g. Walsham 1995, Newman & Boland 1996, Buttler 1998). It gives a more holistic view of the phenomena. The interpretative stance to this phenomenon indicates that the organisation should be taken from the view of the individuals. We should first see what the individuals see and feel about the phenomena. After that we have to interpret phenomena and find the "real" meanings for what came out from the interviewees. According to our view the social system is a mental construction of the individual people and the goal of the analysis is to *understand* the 'life-world' of the people involved. We also regard the organisation as being under continuous change. The essence of the organisational behaviour is in its behaviour of change rather than in its structure of status quo. New trends and innovations affect its behaviour causing small but sometimes also radical changes in the organisation. These changes come through its most innovative staff-members who are trying to develop their working methods. This view is strongly related to the paradigm of radical change of the radical humanist and radical structuralist theories (Burrel & Morgan 1979 p. 22). There will always be some discrepancy between the different 'life-worlds' of the people working in the organisation. The true change comes from contradictions and causes contradictions. The IT and THE EUADers are as artefact builders, also creators of new organisational life-world. For the research work, this means questioning the existing power structures that maintain the status quo in organisation (Doolin 1998). The

Business Process Reengineering (BPR) also means (Järvenpää & Stoddard 1998) the radical change from an objectivist and managerial standpoint.

We think that, especially when studying organisations that are continuously under change driven by new knowledge, the interpretative approach is the most appropriate. It is the people who construct the organisation. The organisation is in the heads of individuals in the form of knowledge, values, attitudes, experiences, etc… The effectiveness of the organisation is based on how well the people acquire new knowledge and share it. Organisations do not create knowledge by making plans, but the source for new innovations and knowledge creation will always depend on the willingness and creative learning of individual people. The task of management is to organise the working environment to give space also to that kind of activity that is motivated by the personal point of view. We think that those companies, whose staff members are committed (Abrahamson 2001) and work for their employer from their own will, will succeed best in modern society.

We think that there will always be a gap between the formal organisational and social structures. It is a hopeless attempt to try to tie all the organisational activities into organisational control. The innovations and knowledge rise among the voluntary and self-steered staff members in the working practice. This does not mean that the organisation is not manageable. On the contrary, the formal organisation can be *managed* and people can be *led*. It is up to the organisational management and leadership to fill this gap.

The goal of the study is to describe the voluntary and unplanned activities in organisations from the actors' own view. Our main task is to describe their personal motivation and process to start developing applications. We also describe their efforts and individual strategies in their activity. Finally, we analyse the consequences of that activity on their work contents and personal career as well. We state three research questions: 1) what is the EUADers personal adoption process like? 2) what are the efforts and individual strategies of the EUADers in the EUAD activity? and 3) to what extent has their work been changed due to their EUAD activity?

The findings may help us to understand the most active end-users and give ideas to the management about what to do with those people in order to take their activity into the use of the organisation. We want to discuss the problem of the "right" relation between the free creative activities and pre-planned, organised actions in good management.

Later in this report we shall show how we tried to solve our research problems. To orient a reader into the rest of this report we shall give a short review on our results. The findings

show that the EUADers are willing to work hard and continuously develop their knowledge. They all consider the application development activity as interesting and enriching for their work. The intrinsic motivation is the most dominating reason to start the application development.

The adoption process followed two different alternative patterns depending on the type of the EUADer: the (i) desire-driven pattern of adoption that is mainly based on intrinsic and (ii) the requirements-driven pattern that base on extrinsic motivation. The EUADers following the first pattern actively looked for cases where they could use their skills of computing whereas the second group of the EUADers used their skill primarily in the work context when needed. We also found four groups of the EUADers depending on what role the EUAD activity played in their work. The first group called inventors took the EUAD as a hobby. Those persons developed their applications using professional tools and also found themselves later as IT professionals. The second group, utilitarian users, took the EUAD as a tool to improve their actual work performance. They used spreadsheets and database programs as tools and did not have any other motives. The third group, called work enrichers, wanted to make the work more interesting and, as utilitarian users, did not intensively look for being IT professionals. Finally, the opportunity seekers were that type of the EUADers for whom the EUAD activity played an important role in their position in their workplace. For this group the EUAD activity was an opportunity to get a job as an IT professional or somehow in some other way had a prominent contribution to their status in their working place.

The findings show that whatever the context and motivation are, the EUADers are committed and highly motivated. The EUADs rely on themselves, are satisfied with their work and are also committed to their own working place. Because of the unplanned and personal nature of that activity they are quite lonely with the activity. They still work hard and learn on their own even without any systematic methods. Anyhow, they are systematic and act experimenters as learners. This study therefore suggests that the management should consider more the intrinsic motivation and reserve more time for end-users to learn and develop working practices.

The rest of this study is structured as follows: In Chapter 2 we outline the topics of the study. Firstly we analyse the key concepts of the study, after that we set the research goals and questions, and finally we describe how we conducted the study. We describe how we selected the informants and give some basic data about their personal and professional backgrounds. We also describe the paradigmatic assumptions behind the study and give reasons why we choose an interpretive approach. In Chapter 3 we introduce the personal stories of the informants and in Chapter 4 we analyse the data in respect to their personal

learning styles, actual work contents, and the personal process of developing EUAs. In Chapter 5 we draw conclusions and discuss the study. Therefore we relate the findings to the contemporary findings and theories about technology, knowledge creation and learning in organisation. We also analyse the knowledge as a resource in organisation and individuals as users and adapters of IT-technology.

2 Research Topics

In this chapter we firstly explain the basic concepts about end-user application development, creativity, innovation and learning in Section 2.1. Secondly, we set the goals and research questions for the study in Section 2.2. Thirdly, in Section 2.3 we describe the paradigmatic assumptions of information systems science about organisations. We also explain the basic assumptions of the researcher and try to give arguments about why this kind of study should take the qualitative method as the research approach. Finally, we describe how we conducted the empirical study and describe the methods and conceptual framework when interpreting the data.

2.1 Basic Concepts

2.1.1 End-user (EU)

We study the phenomenon of end-user application development. It is one instance of the learning-intensive activity of white-collar workers today. We try to analyse the problem of end-user application development as an organisational behaviour from the end-users point of view. Heikkilä (1990) defines end-user as a person who "*uses a computer as a tool to support his/her task actively and spontaneously*". He characterises a typical end-user as a "*well-educated manager or expert with authority to arrange his/her job*". An end-user, thus, has some freedom in his/her job. The adoption and use of micro computers in a professional way, is a learning-intensive process and requires extra efforts to learn and follow the ever-changing field of software technology (Heikkilä 1995). In their seminal article Rockart and Flannery (1983) classify the end-users into six groups:

(1) non-programming end-users
(2) command-level users
(3) end-user programmers
(4) functional support personnel
(5) end-user computing support personnel
(6) DP-professionals

The end-users of group (3) – (5) use procedural programming languages or application generators. They develop programs for themselves and many of them (29%) for others, too (Hacharthorn 1987). The classification above is very widely used in the IS literature,

but it is quite old. The distinction between command level (2) and programming (3) end-users can be ambiguous today. The office tools today contain many graphical and procedural tools to define application. For instance in Access (Version 7) the user defines the sequence of commands by using a user-friendly graphical interface, but he also has the possibility to develop applications in a professional way.

2.1.2 End-user Application (EUA)

The basic distinction between the end-user application and organisational application is that the end-user application is originally

1) developed by the end-user,
2) from his/her own initiative, and
3) for the use of the end-user him/herself.

All the criteria will not always be fulfilled. Some of the applications are developed or taken into organisational use whereas some of them have originally developed for the use of other people. The application has, however, to include the first two 1) – 2) criteria. The main criteria stress innovative and individual nature of development.

2.1.3 End-user Application Development (EUAD)

Brancheau & Brown (1993) define end-user computing (EUC) as "*the adoption and use of information technology by personnel outside the information systems department to DEVELOP software applications in support of organisational tasks*". The difference between EUC and the EUAD is not quite clear. The EUC as a term has become controversial in the IS literature (Forsman 1998 pp.150–157). The authors stress three different tasks in the EUC: use, develop and operate. The meaning varies according to which task the author stresses. There seems to be two schools of thought: *The user view and the developer view.*

In this study we stress the developer view, in which the EUAD covers the activity where:

(i) the person's actual job is other than IT professional (he or she is an end-user)
(ii) the EU develops applications which require also higher level programming skills and
(iii) the EU creates applications mostly for his or her own use, but also for use by others.

(iv) the EU has started his or her EUAD activity, and it is also mainly driven by his or her own initiative.

Most of the studies about the EUAD have been conducted in the 1980's when the end-users used stand alone microcomputers. There was a lack of applications and the end-users did not have access to the organisational applications and databases. The rapid progress of information technology and networking and enhancement of capabilities of general software as a part of IT infrastructure, e.g. Microsoft Office and similar products in organisations have decreased the need for developing applications for others by end-users. In the 1990's the local network and Internet provided ready-made applications and access to databases, as well.

2.1.4 Creativity and Innovation

Creativity is linked to the person's ability to create new ideas and see the problem from different viewpoints. Innovation refers to the activity of acquiring new ideas and inventions into practice. This process by Rogers (1995 pp. 20) consists of four phases: *Knowledge – Persuasion –Decision – Implementation*. The concept of innovation refers to the *shift* from an earlier stage to the next one. Creativity refers to the ability to create something new or enrich the stage in the adoption process. Usually, innovation refers to the last stage when the end-user adopts new technology or creates it by him/herself.

2.1.5 Motivation

The EUAD activity can also be seen from an individual point of view i.e. as actions from the motivational standpoint of the adopter. Motivation is the reason or intention of the individual actor, which makes an individual to act in the organisation. According to Davis et al. (1989), the motivation structure of persons consists of three factors:

1) The *intrinsic motivation:* The process of performing the activity per se. The activity is performed because it is enjoyable. Playfulness belongs to this category.
2) The *extrinsic motivation:* The process of performing the activity because of the reinforcement value of outcomes. This motivation is linked to the "perceived usefulness" of the action in relation to the outcomes. Also each of the Rogers' characteristics: relative advance, compatibility, complexity, trialability and observability can be listed to this category.

3) *Subjective norms:* The social norm to perform or not to perform the behaviour. The person thinks that he has to perform the action in order to be a good worker in the eyes of others. The subjective norm refers to "*the person's perception, that most people who are important to him think he should or should not perform the behaviour in question*" (Davis et al. (1989) excerpt from Ajzen & Fishbein 1980).

2.1.6 Learning and Learning-intensive Technology

The activity of the EUAD in organisation is fundamentally an issue of learning. The interpretation of how people adopt and learn to use new software technology depends on how the researcher approaches the process of learning as a whole. It is widely acknowledged that learning includes both conscious and cognitive as well as unconscious and social features. We can also stress the personal differences between individuals as learners. When studying motivation, the social and psychological features make sense in the process of learning. On the other hand, learning of new software technology is also cognitive and goal-oriented in nature. These features still work differently among individuals: some people are more social and practically oriented whereas actions of some others is based on systematic rules and theoretically argumented concepts.

The EUAD activity itself is one of the most active parts of the learning-intensive (see below) working practices. The adoption process of new technology, particularly when concerning information technology is substantially adaptive. Heikkilä (1995) makes the difference between the learning of 'industrial' technology and learning of 'intellectual' technology. The 'industrial' technology requires mainly learning of skills, which can be acquired by training. The 'intellectual' technology requires "both the training, and iterative ongoing learning in the use context, where training, goal setting, and feedback evaluation alternate" (Heikkilä's 1995, pp. 16 excerpt from Curley & Pyburn 1982).

One approach of learning is given by Engeström (1994). According to him, learning is a construction where the "learner constructs a picture of the world. The student always ends up correlating and merging newly acquired material into his or her ongoing activity and earlier construction". Learning is meaningful, when new knowledge and tasks run into the learner's activity. What is essential in the process of 'industrial' and 'intellectual' technology, is the presence of tools i.e. learning takes place in a situation where tools are needed to solve the problem. Engeström (1994) draws a framework about productive learning as shown in figure 2.1.

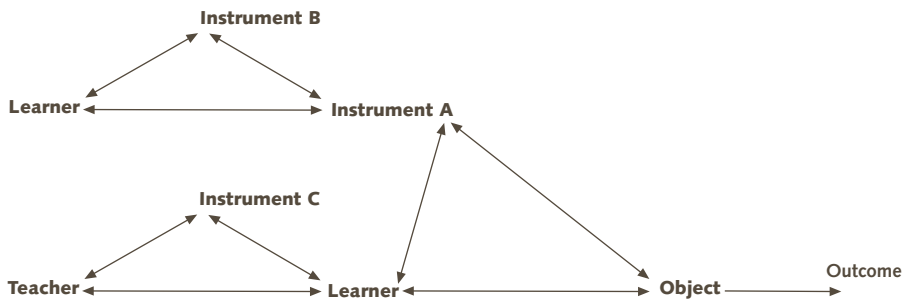

Figure 2.1 *The Structure of Productive Learning in Everyday Situations (Engeström 1987).*

The learning process concerning the end-user application development covers two topics (Figure 2.1): the organisational *task* to be done and the technology in the form of the *instrument* used. The instrument takes part in the learning process in three different roles: (i) the instrument used in the organisational task (*Instrument A*), (ii) the instrument needed when a learning the organisational task (*Instrument C*), and finally (iii) the end-user needs a software tool as an instrument (*Instrument B*) to develop an application (*Instrument A*) for the organisational task. The EU as a learner uses instrument A developed by him/herself in transforming an object to an outcome.

In the case of the EUAD, the end-users use instruments to develop the applications. The role of the instrument is not only the tool used in the task, but it is also part of the knowledge and orientation basis for the problem to be studied (see Engeström 1994, pp. 42). The learner orientates the object using his or her orientation basis consisting of all previous knowledge and instruments on hand. The object of learning in this case is basically the problem area to be solved. The EUADer develops an information system as a representation of a real-world system as perceived by users (Wand & Wang 1996) who in this case is the developer him- or herself. The view of the real-world system is captured in the design of the system. The application used shapes the problem area, and can be regarded as an explicit picture or a model about the object to be learned. The development of end-user applications can therefore be regarded as a good way of productive learning too.

The ideas of Productive Learning originate from Engeström's activity theoretical approach to learning activity (1987). According to him (1990) the work of people is organised as 'activity systems'. The activity system integrates the subject, the object and the instruments. The system incorporates both the productive and the communicative aspect of human conduct. The organisational culture has its effect on the attitudes of staff members and how deeply and openly they learn new things. The "knowledge, skills and attitudes are

closely merged together" (Engeström 1994). The context of actions, in which the human is working, is nothing else than the activity system itself.

Due to the principal role of activity systems, the learning and working has to be investigated as an indistinguishable part of the activity system. The theory has three methodological principles for interpretation (Engeström 1990 pp. 78). According to the first principle the unit of analysis must be the activity system as a whole. The system is considered as "a continuously constructed collective *activity system*, which is not reducible to series or sums of individual discrete actions". The second principle bears the idea of historical progress. The activity system is in continuous progress towards a higher level of society. Therefore the principal basis of classification is the historicity. These levels can be distinguished into "general historical types of activity" depending on how the activity system is organised and how complex it is by nature. The third principle bears the principal idea of change. The activity system is unstable by nature. It bears inner contradictions that are the source of random periodical of planned change and development. The development of the activity system can be understood only by tracing the disruptions, troubles and innovations caused by those contradictions.

As a learner, the human being has a dual role in the activity system: he is a reproducing and producing, as well as a conserving and inventing actor in that system. He is a non-conscious user and adopter of instruments and, at the same time, reproductive user of these instruments. He can even question the usage of the instrument and the problem to be solved by setting up new problems and goals. Engeström (1987) solves this by depicting the learning process in three hierarchical levels: The *Learning I* constitutes the no-conscious behavioural routines; it is change in behaviour by correction of errors. *Learning II* represents the generalisations of routines like models, general rules and principles. This is what is commonly understood as learning. *Learning I* and *Learning II* are always embedded. In *Learning III*, the subject becomes conscious and gets an imaginative mastery of the whole system of activity. He becomes aware of the inner contradictions of the system and may also reformulate the social dilemma as a whole.

The human activity is learning to create and use new instruments of production. The activity system as a whole shapes the human activity both as reproductive worker and productive learner of society. The inner contradictions of the activity system act in background as the original source of innovations and changes. The role of the human being is to become conscious of these contradictions and renew the system. According to Engeström, the human activity is basically rational and the process of learning is conscious and cognitive by nature.

2.1.7 Personal Learning Styles

Another approach of learning is to view it from the viewpoint of individual learner. Learning and adoption of new technology is basically an individual process by nature. No all the people learn in the same way: for some of them the learning is cognitive, but for others, the personal experimentation and practise play a central role in the learning process. Each learner has a personal learning style of his or her own. We can compare how the individuals differ from each other as learners. Therefore, it is important to study how personal strategies differ between different end-users when adopting new functions of the software or using it in an innovative way.

A well-known model about learning is the Experiential Learning Model by Kolb (1984). It helps to understand the learning process and the differences between different people as learners. The process of experiential learning is illustrated in Figure 2.2. It is a four-stage cycle. At its best, learning begins with the learners' own experience about the phenomena to be learned. He or she makes observations and reflections in order to formulate abstract concepts and generalisations. This theory is then applied and experimented in real world situations to create new concrete experience.

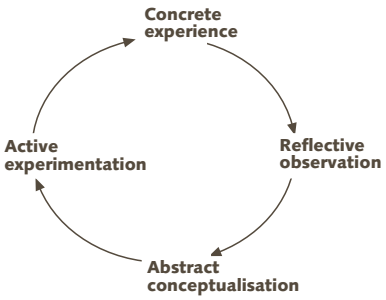

Figure 2.2 *Lewinian Experiential Learning Model (Kolb 1984 p. 23)*

Learning is a continuous process, which covers all these four stages. The *concrete experience* indicates acting and "learning by doing". In this stage the learner apprehends the world in time and space. Apprehension is closely linked to the concept "look and feel". Through *reflective observation* the learner adapts the feelings of his or her experiences by internally reflecting on their symbolic impact on his/her feelings. He or she gives new attributes and properties to the observations to grasp an intentional

apprehension of the world. The *abstract conceptualisation* indicates thinking and building theories from experience. This mode of learning indicates comprehension of the world in terms of rules in explicit and transformable form. When, on the other hand, there is *active experimentation* of concepts in new situations, the learner applies and tests the concepts into practice to grasp an extensional comprehension of the world. These two transformation processes complement each other in the cycle of learning. It is dialectic interplay between generalisations and experience.

The different modes of learning also cause conflicts between abstract concepts and concrete experience or between reflection and action. Good learning is a tension- and conflict-filled process. "This conflict among different adaptive modes needs to be confronted and integrated into a creative synthesis" (Kolb 1994 p. 31). The creativity of the learner means the ability to confront all those four stages of learning and also tolerate and make use of the fruitful conflicts between those modes.

The creativity is closely linked to intrinsic motivation (Oldham & Cummings 1996). This implies that the employees, who experienced high level of intrinsic motivation, are also the most creative. This motivation can be increased by supportive supervisory style. On the other hand, when practicing controlling supervisory style, as goals and control mechanism, the performance can increase, but the creativity will diminish.

The people of different personalities use the stages of Kolb's learning model in different ways. For instance, some people prefer thinking of abstract concepts rather than concrete acting and doing. Kolb names these differences between learners as their different cognitive styles of learning. According to his theory, the people differ substantially from each other in how they acquire new knowledge and how they act in problem solving situations.

The actions of the EUA Developer can be seen as actions of problem solving and knowledge acquisition/creation. Kolb categorises the individual learning styles into four classes by using two dimensions: *active experimentation/reflective observation and concrete experience/abstract conceptualisation*. The active experimentation/reflective observation dimension indicates the personal style of *acquiring knowledge*. The active experimentation oriented people acquire knowledge by testing and applying ideas to see if the new idea works in practice. The reflective observation oriented people rely on reflections of the experiences. The concrete experience/abstract conceptualisation indicates the personal styles of problem solving. The concrete experience oriented people like doing things and achieving concrete experiences. They want to participate in things personally through their own actions. The abstract conceptualisation oriented people prefer theories and thinking. They work problems through abstract concepts and generalisations. These dimensions constitute four styles of learning (see Table 2.1).

Table 2.1 *Kolb's Learning Styles*

	Knowledge acquisition	
Problem solving	**Active experimentation**	**Reflective observation**
Concrete experience	Accomodator style of learning	Diverger style of of learning
Abstract conceptualisation	Convergent style of learning	Assimilator style of learning

The *accomodator styles* of learners rely on concrete experience and like active experimentation. They do things and see what happens. Their activity is based on earlier experiences about the world. They like opportunity seeking and risk taking. They rely more likely on trial-and-error than on analytic thinking or plans. They are good at carrying out plans and tasks.

The *diverger styles* of learners rely on combining concrete and deliberate observations and like generating new ideas and theories. They base their knowledge on their individual reflections and try to understand the meaning of the phenomena as a whole. They are good at tasks where new creative thinking is needed.

The *converger styles* of learners rely on abstract conceptualisation and active experimentation. The people of this style act by following a certain logic or theory. Their activity is based on their knowledge on theoretically argumented experiments. They are good at testing theories and applying theoretically argumented ideas in practice. Their strengths are problem solving, decision-making, and the practical application of ideas.

The *assimilator styles* of learners rely on deliberate reflection and abstract conceptualisation. They are theoretically oriented and able to adapt their reflections into their theoretical framework. Their strengths are in imaginative ability and awareness of meaning and value. They are able to perceive situations from many different perspectives and organise many relationships.

In the EUAD activity the workers apply their individual learning styles when solving problems in using and adapting computer software. In Kolb's research, engineering people are convergers and mathematicians more assimilators. Business-oriented people are accomo-dators (Kolb 1984 pp. 86).

There is a fundamental difference between the two theories of learning described above. Engeström stresses the rational and conscious part of the human being as actor and learner. The learners' acting and thinking is based on the orientation basis like knowledge and instruments. He internalises the problem at hand and externalises the new ways of acting and

thinking into practice. The process continues as critique of his former orientation base and control of his acting and thinking. The circle is quite similar to the Experimental Learning Model in Figure 2.2. For him the ideal type of learning process is like the convergers have in Kolb's classification. For Engeström the learning process is principally cognitive by nature and human beings do not differ as learners in this sense.

Kolb stresses the differences between individuals as learners. He also considers other human features than rational thinking as part of learning. These are emotions, feelings, social relations, etc. Because of these reasons we think that the usage of Kolb's model makes more sense in the analysis of the differences between the EUADers as learners and innovators.

2.2 Research Goals and Questions

Most of the previous studies of end-user computing have approached the problem from the organisational point of view. The issue of end-user computing is primarily considered as a problem of organising and supporting the end-users. The studies of organisational learning have analysed the creation of knowledge as an issue of team and group of different levels of organisation. The differences of individuals as team members have not been studied very much. This study concentrates on people as individual members in an organisation. Although people have similar features as group members, we think that there still exist considerable differences among the group members. People have different roles, learning styles and motivations in the teams. We analyse and compare these differences in the case of the EUADers in the context of innovative and learning-intensive working place.

From the managerial point of view, people are considered to be the most important resource of the company. Especially the most active and innovative people are expected to be one part of the "core competence". In order to take care of these people, the managers have to consider them as teams, but also as individuals. These people have to be taken as personalities with working motives and learning styles of his or her own. This study aims to help the managers to recognise the different types of innovative personalities in the learning-intensive working environment. That follows that the managers select the right people for the right teams and give them assignments meeting the personal characters of these people.

This study has a '*theory-creating approach*' (Järvinen 1999 Chapter 4) about the phenomenon. The primary goal of this study is to analyse and understand the end-users in the learning-intensive working environment. We describe the phenomenon of IS related innovation and learning computing practices in organisations. We especially focus on how the most active individual workers create knowledge and improve their working practices in

the form of EUAD. This is conducted by analysing their individual learning strategies and how they react to problems and adopt new technology. The domain analysed in this study is End-User Application Development, which is supposed to be that kind of activity that, at its best, indicates the desire to develop the working practices of staff members. Special attention is paid to the end-users' adoption process, motivation, styles of learning, perceptions towards the organisation and computing, and tools and methods used. We pose the question: how should the working organisation and culture be organised in order to get the knowledge worker to identify and commit himself to the common mission of the company.

The interview is seen as the most sensitive data gathering technique to elicit data concerning such topics as motivation, adoption process etc. We think that in order to understand the end-users in their working places, we have to approach the world, as it looks in the eyes of the end-users. We also have to understand the end-users as personalities.

We set three research questions focusing on different points of the adoption process. The focus of the first question is at the very early stage of the adoption of new software and office tools. The primary goal is to investigate the motivation structure. The second question is set to describe on the actual process of how the end-users develop applications. Finally, the third research question tries to find out the consequences of the EUAD activity. We will try to find the answers to the research questions in two phases: first by carrying out an interview of the persons and, after that, a follow-up interview of the same persons after three years.

The first research question aims at revealing the motivation structure of the EUADer. That takes us to analyse the very early stage of the adoption process: the times when the adopter makes the decision to adopt or not. At that stage, the personal factors are expected to dominate the most. We set this research question aiming to find out the human profiles and the features of the adoption process of different personalities. Research question 1 is formulated as follows:

Research Question 1.

> ***What is the EUADers personal adoption process like? How do they start the application development activity? Why did they begin to learn and use microcomputers in a professional way? What individual Learning Strategies (Kolb 1984) do they apply?***

Aiming to find the answer to this research question we presented five questions in the first interview and two questions in the follow-up interview. Generally, we tried to get the

informant to tell about himself and describe the starting point of the activity from a very personal point of view. The individual learning strategies are investigated by applying the validated instrument in the form of a formal questionnaire at the end of the first interview. The questions aiming to this goal are as follows:

Q 1.1 Could you tell me about yourself in a few words?
Q 1.2 What is your actual work?
Q 1.3 How did your activities begin with the application development?
Q 1.4 Where did you learn programming? Do you like it?
Q 1.5 What do you think about the future? Do you want to apply for a job as an IT professional?

(The letter "Q" indicates the questions of the first interview and "FUQ" the questions of the follow-up interview).

The follow-up questions aim at giving more understanding for the research question 1. We also want to review the answers of the first interview in light of the answers of the second interview. We can relate the answers of first interview in the right context by asking what really happened to the informant. By the first question (FUQ 1.1) we want to get more information about the motivation of the informant. The second question (FUQ 1.2) aims at finding the general information about the changes of the end-users work career and environment. The questions are as follows:

FUQ 1.1 If you changed your job, what was the main reason for it?
FUQ 1.2 If you think the time from the first interview, what has happened since then? What about your job at the moment?

The second research question aims at finding a description about the adopted activity during the time when the activity is in operation. We want to view the working behaviour both as an individual working method as well as learning method. We formulated the research question 2 as follows:

Research Question 2.

What are the efforts and individual strategies of the EUADers in the EUAD activity? What kinds of applications have they developed?

The working methods come out when asking about the problems in hand, how they solved them, and how they gather information. We also asked whether they had used any formal system development methods.

Q 2.1 Tell me about your application development activity: What kind of applications you have made? What tools you use? How much time does it take?

Q 2.2 What kind of problems have you recognised with application development. How do you solve them? How do you gather information. Do you have any friends to ask help from?

Q 2.3 Do you use any IS development method? Do you document your systems?

By the follow-up questions we aim at finding the changes in their working content, methods and attitudes about the application development. The questions aiming to this goal are:

FUQ 2.1 How is your area of interest changed? Are you still interested in developing applications?

FUQ 2.2 How is the IS environment changed? What tools do you use at the moment?

FUQ 2.3 How do you gather information at the moment?

The consequences of the EUAD activity can be seen primarily in two ways. Firstly, the end-user can get a more challenging job in his/her own organisation or as a new job in service of a new employer. Secondly, the work content and working environment can change due to the EUAD activity. The research question concerning those potential opportunities is formulated as follows:

Research Question 3.

To what extent has their work been changed due to their EUAD activity?

The actual questions looking at consequences mostly concern other people in the working place. That is because the other people in the working place mostly constitute the social context. We look for other people's reactions on the EUAD activity and also how the informant can use other people to the advantage of his own work. The questions aiming to this goal are:

Q 3.1 What were the other persons' reactions to your development activity? (Does the IT-department demand following any standards or other formal organisational procedures?)

Q 3.2 How have your work contents changed due to the applications made? How much do you expect your EUAD activity will increase your contribution in the working community?

Q 3.3: Do you have any friends or colleagues to ask for help and to exchange information with? Do other people use your applications?

The follow-up questions seek long-term changes in the environment and work.

FUQ 3.1 Tell me about the changes in the organisational environment?

FUQ 3.2 What are the impacts of the EUAD activity to the job contents and professional career in long run?

FUQ 3.3 Did you attend seminars, meetings, courses, etc? Do you have any new contacts?

FUQ 3.4 What do you think about the IT as a resource in your job? How important is it to succeed in doing the job?

FUQ 3.5 If you were an IT manager, would you allow your subordinates to develop applications of their own?

2.3 Research Approach

In this section we shall discuss the very fundamental assumptions of the study. These include our philosophic assumptions about the organisation and information systems science. Taking these assumptions into account we then describe how we conducted the empirical study and how we interpreted the data.

2.3.1 Paradigmatic Assumptions

2.3.1.1 The Philosophical Assumptions about the Organisation

When studying organisations, researchers have their explicit or implicit ontological assumptions about the reality to be studied. Especially, when studying human behaviour in organisations, these assumptions should also be made explicit. It therefore makes sense to discuss the nature of social science and organisation to understand the methodological basis of the study.

This study takes the interpretative standpoint toward reality. We therefore stress the importance of the subjective experience of individuals in the creation of a social world (Burrell & Morgan 1979 p.3, Morgan 1980). The emphasis is on understanding the unique features of the phenomenon rather than its universal regularities in objective reality. The phenomenon should be investigated as it reflects in the real '*life-world*' of the subject.

Accordingly, we see our role as being concerned about how the individuals interpret reality and how they create their subjective understanding about the world rather than trying to stay as a neutral observer. Table 2.2 represented differences between the objectivist and subjectivist standpoints.

Table 2.2 *A Scheme for Analysing Assumptions about the Nature of Social Science (Burrell and Morgan 1979)*

Nature of the assumption	The subjectivist approach	The objectivist approach
Ontology	Nominalism	Realism
Epistemology	Anti-positivism	Positivism
Human nature	Voluntarism	Determinism
Methodology	Ideographic	Nomothetic

We accept the nominalist position that the social world exists primarily in individual cognition. It is made up of names and concepts used to structure reality. Nominalism stresses man as a central, conscious and active part of reality who actually creates reality in the social context. The social world consists of names, concepts and labels which are used as a tool to structure reality. This leads us also to the question about the fundamental nature of knowledge. From the anti-positivist view knowledge resides in the cognition of individual people and it is therefore subjective and social by nature. We also accept the subjectivist standpoint that the human being is autonomous and free-willed by nature. The behaviour of man is determined rather by his situational and intentional actions than by universal regularities.

From the previous assumptions we can draw the conclusions about how, in this research, we should acquire knowledge. Taking a subjectivist standpoint, we consider knowledge basically social by nature. Therefore, acquiring knowledge is fundamentally getting inside the social phenomenon and trying to understand the real 'life-world' of people. The task of this research is to understand and describe subjective accounts. The ideographic methods: like case studies and grounded theory are used in this kind of studies (Iivari et al. 1998).

Another fundamental methodological dimension is the researcher's perspective about the nature of society. Society can be seen fundamentally as a stable or a changing entity by nature. This dimension is known as '*regulation – radical change*' debate (Burrell and Morgan 1979 p. 16). The two dimensions: objective – subjective and

regulation – radical change facilitates categorising the social theories into four paradigms presented in Table 2.3 as follows.

Table 2.3 *Burrell & Morgan's Classification of Social Theories to Four Paradigms*

	Subjective	Objective
Radical change	Radical humanism	Radical structuralism
Regulation	Interpretative	Functionalism

These four paradigms characterise the work and role of the researcher very fundamentally. The role of the researcher is categorised in Table 2.4.

Table 2.4 *The Roles of Research (Chua 1986)*

Role	Aim
Means-end oriented	Achieve given ends
Interpretative	Give meanings to actions
Critical	Indentification and removal of domination and ideological practice

The interpretative paradigm deals with seeking explanation for the behaviour of individuals in organisation. The paradigm tries to understand social life as it is. The task of the researcher is to give meaning to the observed actions. As opposed to the value-free, mean-end oriented view of functionalist paradigm, the interpretative paradigm stresses the value-laden, subjective nature of research.

We also accept the view about the changing nature of the society of the radical humanist paradigm. The paradigm (Hirschheim et al. 1995, Lyytinen & Klein 1985, Lyytinen 1986) describes the information systems development as a social action. It emphasises the active and emancipatory role of man in the process of change. There is unused potential everywhere and it is natural for human being to materialise it. The role of science fosters this

tendency and frees man from the chains of the organisation in order to allow for maximal realisation of human potential (Järvinen 1999 pp. 119). Modern society is a technocratic mass society in which work as technical manipulation is extending at the expense of the human spirit. According to the paradigm the dominance of the ideological superstructure on human consciousness limits the endeavour of man.

2.3.1.2 Formal and Social Organisation

The paradigmatic assumptions require us also to emphasize the difference between the formal and social side of the organisation. The organisational management can have the control of the formal, explicit organisation, but the actual practices and operations are still more under the influence of informal, social organisation. The people working in the organisation are quite a difficult object to manage. This is especially true in the knowledge intensive companies.

Boland and Tenkasi (1995) analysed the process of knowledge creation as a social communication system within knowledge workers. They emphasise that the rational analysis of data must be supplemented by recognising that humans also have a *narrative* cognitive capacity. In social practices people almost continually narrativisize their experience as they recognise events and construct stories, which make sense. It is a process of "language games" in the social practice. The narrative mode of cognition serves an important role alongside the canonical structure of organisation. It provides access to the implicit and interpretative structures of knowing. The narrative explanation works not only because it is logically acceptable, but also because it is lifelike and plausible and it fits the culturally bound demands of a form of life.

Another way to support the process of knowledge creation is to concretise the knowledge used with visible and touchable objects. Hargadon and Sutton (1997) have shown how the artefacts of earlier projects can help product designers to create new product ideas. The artefacts are set to lie around the offices as reminders of interesting and potentially useful technologies, patiently awaiting the appropriate problem. Technologies, in an abstract and conceptual form, carry the potential to address many different problems in many different industries. In most cases, designers learn possible technologies by seeing them in existing products, in specific forms intended to serve particular industries. To recognize the potential value of a product's technological components, the designers must abstract them from their specific, past implementation before adapting them to meet the needs of the current problem.

Brown and Duguid (1991) have studied "communities of practice" from an educational point of view. They realised that the ways people actually work usually differ fundamentally from the ways organisations describe that work in manuals, training

programs, organisational charts, and job descriptions. The social organisation has its own independent knowledge-creating behaviour. It supplements or replaces the canonical knowledge of work. For example, the manuals in the technician's work do not always meet the requirements of the actual work in practice. They were mainly technical descriptions about the machines and were based on a very restricted model of how the technicians are acting in the work. The instructions usually describe how to recover from certain error situations. The work itself is much more complex. They have to work in a daily changing environment and respond to *ad hoc* situations, which cannot be described in manuals or training course materials.

The technicians are totally aware of the superficiality of the training programs and they develop their skills in daily work or in the "learning-by-doing" program. Real practice is actually not just maintaining technical machines by following predefined instructions, but more likely, it is maintaining machines in very complex, ever-changing conditions and also maintaining social relations. Solving the problem consists of, in addition to the technical problems, keeping the customers and maintaining the image of the company.

The knowledge needed in technicians' (Barley 1996) and other knowledge work (McDermott 1999) is mostly contextual by nature. They need pragmatic knowledge to make sense about the signs and codes of the events of machines. They also often need knowledge about the local idiosyncrasies of specific materials and instruments, which never could be written into documents. When they solve problems, they use heuristics or rules of thumb rather than exact and theoretical knowledge about the behaviour of machines. They also need sensory motor skills for using instruments and materials. The knowledge from textbooks and manuals simply cannot cover the knowledge acquired from experience. In the technician's work, the knowledge needed is mostly unwritten and tacit by nature. These unwritten narratives circulate through the community in many ways, stories at conferences and chance hallway meetings. It comes from years of experience learned from different work situations and narratives of their peers.

The need for expertise and social networks in the knowledge work also affects the form of control mechanism, which suits best. The ideal bureaucracy with authoritarian command structures does not work. Managers can exercise authority only to the degree that their knowledge encompasses that of the subordinates (Barley 1996). The technicians' work is decoupled from the authority of expertise rather than the authority of position. The people are dependent on each other's through the network of different knowledge and expertise. All this stresses the importance of knowledge about the behaviour unofficial social organisations as well as the individual motivation structure at work.

2.3.1.3 The Assumptions of Information Systems

The ruling paradigm of organisations in information systems science is the functionalist view of organisations (Iivari et al. 1998, Orlikowski & Baroudi 1991). There are signs that the dominance of this positivist approach has to give space for other research traditions too (Walsham 1995). The interpretative paradigm gives a more holistic view of the phenomena. Information systems researchers have increasingly begun to acquire social and psychological factors and theories to analyse user behaviour in information systems usage. Examples of this are Social Cognitive Theory (Compeau & Higgins 1991), Computer Self Efficacy (Marakas et al. 1998), Intrinsic and Extrinsic Motivation (Thompson et al. 1999), User Competence (Munro et al. 1997, Davis et al. 1989), etc.

Table 2.5 below compares the basic ontological assumptions between the functionalist and interpretative paradigms about the phenomena.

Table 2.5 *Sub Dimensions of Functionalist and Interpretative Approaches (Iivari 1991)*

Object	**Assumption 1** functionalistic	**Assumption 2** interpretative
Information/ data	descriptive facts	constitutive meanings
Information/ data system	technical	organisational/ social
Human being	determinism	voluntarism
Technology	determinism	human choice
Organisation/ society	realism/ structuralism	interactionalism/ nominalism

The view of information/data is the most significant because it is also an epistemological dimension. The information can be seen as simple facts or constitutive subjective meanings about the reality. From the interpretativist view information technology should be investigated as a part of a social system by both of them affecting each other. The information systems are designed for the use of social system and used in the context where users act as social actors. People's mental models and organisation's structure and culture significantly influence how technology is implemented and used. People, as they

interact with a technology in their ongoing practices, enact structures, which shape their emergent and situated use of that technology (Orlikowski 1992, 2000). We can consider the IS as "*a technical implementation of the social system*" (Iivari's (1991) excerpt from Goldkuhl & Lyytinen 1982).

Information systems are part of the social system in which the tools used mediate, systematise and maintain the social relationships of its members. The technology of IS itself is a technical construction, but it is specially designed for the use of a social system. Therefore, when studying the IS, we have to study the information technology in organisational activity through 'an understanding' of the *context* of the information systems, and the *process* whereby the information system influences and is influenced by its context (Doolin 1998). Therefore, when studying the IS, we have to study the organisational activity within the exploitation of information systems.

The role of information systems is therefore very fundamental in organisations. They are, as an essential part of the organisation, socially contracted and sustained human artefacts. They are designed and used by people operating in a complex social context. Information technology forms part of an environment, within which managers, developers and users interact in order to develop shared meanings and interpretations of an ambiguous social reality. Social relations are instantiated and mediated through technology, and organisations are made relatively cohesive and stable by the way they are intimately bound up with the technical system (Doolin 1998). Technology is both a condition having impact on the social context, and also a consequence of this context.

Another effect of new information systems is that they change the fundamental nature of work toward the direction where the actor processes abstract objects and transactions. The information systems have, besides the '*automating*' effect, also an '*informating*' effect (Zuboff 1988). 'To informate' means to translate and make the abstract processes, objects, behaviours and events as visible explicit information. Information technology should be designed with the intention to informate work, and thus enhance worker flexibility and autonomy. Used in this way, information technology would enable the decentralisation of organisational power in new forms of networked, learning organisations consisting of knowledge workers empowered through technology (Doolin 1998).

The organisation and usage of IT is under continuous change. The change is not always incremental adaptations of new technology, but also radical, frame-breaking changes happen periodically. Lassila and Brancheau (1999) have described how the introduction of new information technology work as a trigger for redesign business processes causing a revolutionary period that leads to a new pattern of technology utilization. During this period of transition the organisation has to provide adequate training, experimentation, and encouragement for communication and participation.

of transition the organisation has to provide adequate training, experimentation, and encouragement for communication and participation.

A successive change in organisational work practices needs creative and reflective pioneers. A creative reflectivity means reflective rethinking of these social changes in the context of organisational work practice. 'Being critical' (Doolin 1998) means questioning the existing power structures as well. The conflicting interests and views can be solved in a rational discourse, where no preferred interests or values have dominance as well as the unwanted anarchy, where no argument wins, should be avoided (Flood 1996).

The creation and usage of information systems can actualise new possibilities and also change the power relations. This is especially true in the learning-intensive work that requires personal responsibility and individual thinking. We think that, especially when the work is dominated by creation of knowledge and continuously changing working methods, the interpretative approach with a critical aspect meets the challenge of understanding human behaviour in those circumstances. The nature of innovative learning and knowledge creation in a certain extent needs an open and supportive environment, which fosters the self-steering emancipatory nature of the human being. This paradigm is also likely to foster creativity and excellence (Nurminen 1997 p.36).

In this study, the end-user developers are seen as voluntary actors in the world. The actual world takes place in the working environment constituting all the organisational structures and concepts. The prior intention of end-users is to make sense of the world by working and taking part in discussions. The EUAD activity is an example of attempts to make the end-user and his/her work important in the organisation. Human beings are basically active and sense-making actors, who do not only want to adapt to the organisational power structures, but also want to contribute and make sense of their existence there.

2.3.1.4 The Philosophical Assumptions of the Study

Phenomenological philosophy focuses on the social analysis of human consciousness (Higgs 1995 pp. 7–9). The social system is seen as a mental construction of the individual human beings. According to the theory, the behaviour of human beings is intentional and *inter-subjective*. The intentionality indicates how the real world appears in human consciousness. The meanings of the actions originate from the intentions of the actors.

The formal structures, like language, information systems and organisations, are names and concepts, which get their meanings in the context where they are used. In these actions, they form a world of 'shared understanding'; it is, people learn to know how to react to different actions. The social system is like a game of actions and reactions of language and body (Hirschheim et al. 1995 p.149, language game see Wittgenstein 1972). In the same way

the usage of new technology in the context of the EUAD is one way of expressing the EUADers' intentions in the organisation.

Hermeneutics is a method that makes phenomenology to work in scientific research. This method is also introduced in IS literature (Boland 1995, Buttler 1998, Doolin 1998, Klein & Myers 1999). The methodological essence of hermeneutics is the *cycle of understanding* (Figure 2.3). It bears the idea that the understanding of phenomena should be started with its basic structure. This 'whole' guides the interpretation of its parts from which phenomena are comprised.

According to the philosophy of hermeneutic method the actor is in his or her 'life-world' or context. This view known as 'Being-in-the-world' is characterised by its *throwness* (Buttler 1998). In social life actors find themselves in many situations where their knowledge and understanding is incomplete, they cannot avoid acting, they have difficulty reflecting on their actions and they cannot predict the eventual outcomes of their actions. When reacting to the situations in the context, they use their tacit 'pre-understanding', which is based on their prejudices and experiences of the world. It is historical and also affected by traditions and internalised authority in the human consciousness. The situations of social life appear to the actor as *'ready-to-hand'*.

The actors are active and intentional by nature. They try to see possibilities and act to achieve their goals. In order to do that, they *'break down'* the phenomenon into its parts in order to view the parts of the phenomenon in a different light. In so doing, the phenomenon is *'present-at-hand'*. By reflective thinking they reinterpret and fuse the parts into new understanding about the phenomenon. Different perspectives arise and the 'whole' can be consolidated again. The whole process is a reflective dialogue between the 'whole' and its' parts. The 'whole' is understood through its parts and vice versa.

The process of hermeneutic understanding is a continuous circle from pre-understanding to understanding and again into a new understanding of the phenomenon.

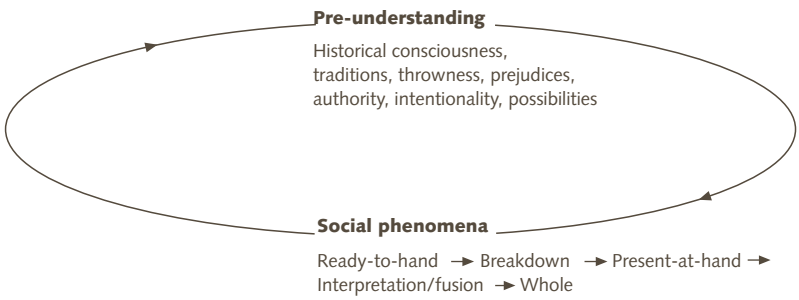

Figure 2.3 *The Hermeneutic Circle*

In this study the hermeneutic circle works in two ways. Firstly, during the process of data collection our understanding about the phenomena increased after each interview. We could formulate the questions better, interpret the situations better. Secondly, the follow-up interviews were designed after the analysis and interpretations of the first round of interviews. We could recheck the first interpretations and make the understanding deeper.

2.3.2 Empirical Study

2.3.2.1 About the Sample

The empirical study is based on interviews of ten end-user application developers. The data were gathered in 1996 and 1997 and a follow-up interview was carried out more than three years later in fall 2000. All interviewees were persons who voluntarily and chiefly from their own initiative attended the interview. That is why people were not asked to join the interview but rather the persons had to ask the researcher to join in. This principle aimed at selecting only persons who are active and who are willing to reveal their real motivations, attitudes as well as opinions. They are expected to have something important to say to their own organisations.

Some of the interviewees were picked from a Visual Basic course in an Adult Education Centre in the Lahti region. The researcher was unknown to the lecturer of the course, as well as to the students. At the beginning of a class, the researcher told the students what kind of people he is looking for. He asked those people, who met the criteria (see Section 2.1) and wanted to join the interview, to write his or her name and phone number on the list. The situation was as neutral as possible, so that only the right people could be picked. Five persons out of twenty wrote their names on the list. The persons were checked to meet the criteria after the first interview. One of the persons on the list was dismissed because of not meeting the criteria. Another selection medium was the Internet. The researcher put a 'call for interviewees' into a discussion group with a title: "*Do you write programs, even if you are not an IT-professional?*" This method brought four more persons. Three of the interviewees were selected because the researcher knew them to meet the criteria.

The sample can be called *convenience sample* (Cunningham 1997). It is rather small, ten persons, but it is still supposed to represent the ideal types of the EUADers. Cunningham (1997) mentions a problem that only those persons, who are the most willing to join, will also be represented in the sample. Actually, this is the case in our research sample. Anyway, this study is also a special case, because the most willing also

represent the right persons who should be selected. The course from where most of the participants were selected was specially planned for the EUADers. All the attendants were also volunteers. The selection criteria were informed of beforehand so that those who did not meet the criteria also did not participate. Additionally, this sample is quite compatible with the findings of earlier research about the backgrounds of the EUADers. In this sample, most of the EUADers are rather young, well-educated and male. The factors like male gender, younger age, and education are associated with the computer skills in earlier research (Harrison & Rainer 1992). It is also shown that the EUADers, as also in this sample, tend to be more experienced (Brancheau & Brown 1993).

2.3.2.2 The Implementation of the Interviews

The data were gathered by interview using open questions. The questions were not shown to the persons, and they were asked in different order depending on the situation of the interview. The informants selected the place for the interview. Of the first interview, were conducted in their working place and two in a cafeteria. The atmosphere was relaxed and informal. The informants were also encouraged to express their opinions, ideas, and plans for the future as well as all other things that they had to say. The informants also spoke very openly about their EUAD activity. At the end of the first interview the informants were asked to fill the questionnaire to test their learning styles (Kolb 1984, the test used see Virolainen and Kerola 1990). For each person, his or her individual learning style was investigated.

The follow-up interview was conducted more than three years later. All of the persons were also willing give the follow-up interview. The appointment for nine of the follow up-interviews was agreed to take place in relaxed circumstances as in the first round. Because of some coincidences, three were conducted in a bar and one in the informants' car. The reasoning for the questions are listed below.

The interviews were recorded into tape and transcripted on paper. The total amount of data analysed was 56 A4 pages in first interview and 42 A4 pages in the follow-up interview. The descriptions of the informants and their work history were sent to the interviewees for checking. Some missing information and corrections also were then provided.

2.3.2.3 The Questions of the First Interview

The questions of the first interview: aiming the research question 1: "What is the EUADers personal adoption process like?" (Section 2.2)

Q 1.1 Could you tell me about yourself with a few words?

This question asks about the personal background. We want to know how the person experiences him or her self and what features the person wants to expose to the researcher. The style and length of the story is also important.

Q 1.2 What is your actual work?

We want to know how many information tasks the job contains and what kind of work it is? The independence and possibility to make one's own decisions may also relate to the factors of the EUAD.

Q 1.3 How did your activities begin with the application development?

This question inquires about the early stage of the adoption decision. This question is expected to deal with one of the most important phases of the informant concerning the EUAD activity. We want to know the context and motivations affecting the adoption process. By telling how the whole story started, the informant will expose his or her basic motives, views, values, desires and everything that made sense for him or her personally. Also the overall situation in the work place and in organisational computing is important.

Q 1.4 Where did you learn programming? (at school?, workplace?) Do you like it?

We want to know the earlier programming skills. Is it necessary to have the skills of programming beforehand?

Q 1.5 What do you think about the future?
(Would you like to learn more about application development? Do you have plans to switch to an IT-professional?)

This question is for revealing the confidence of the EUADer in his or her professional career. It also tests the person's motivations towards the EUAD and, maybe, reveals the person's perception about him/herself.

The questions of the first interview: aiming at research question 2: 'What are the efforts and individual strategies of the EUADers in the EUAD activity?' (see Section 2.2)

Q 2.1 Tell me about your application development activity. What kind of applications you have made? What tools you use? How much time does it take?

This question is supposed to get basic data about the application development: tools, development intensity, and the types of applications made. This question may also generate various data related to these terms.

Q 2.2 What kind of problems have you recognised with application development. How do you solve them? How do you gather information. Do you have any friends to ask help from?

This question gives data about the basic methods how the EUADers solve problems. It also gives information how professional the working is. The problems raised are important to be aware of if the management is willing to foster the EUAD.

Q 2.3 Do you use any IS development method? Do you document your systems?

This question is for analysing working methods. We also want to know if the EUAD is capable to use or is he or she even willing to learn to use any.

The questions of the first interview: aiming at research question 3: "To what extent has their work been changed due to their EUAD activity?" (Section 2.2)

Q 3.1 What were the other persons' reactions to your development activity? (Does the IT-department demand following any standards or other formal organisational procedures?)

This question is supposed to reveal the relations of the EUADer to the organisation. It also shows what the EUADer thinks about the organisation. The perception about the human resource management is also important.

Q 3.2 How have your work contents changed due to the applications made? How much do you expect your EUAD activity will increase your contribution in the working community?

The EUAD may change the work contents in many ways. For instance, the EUADer can be promoted, the contents of his/her work may change. The latter is maybe a consequence of the EUAD activity or it can also happen because of the overall changes of the organisational computing.

Q 3.3 Do you have any friends or colleagues to ask for help from and to exchange information with? Do other people use your applications?

This question aims partly at the same information as question Q 3.1. Especially, we want to know how do the organisation and the web of communication links help them in their EUAD activity. This question inquires the organisational aspects of the EUAD. It gives information about to what extend the the EUAD affects the work contents and other organisational tasks supplementing question Q 3.2.

2.3.2.4 The questions of the follow-up interview:

The main purpose of the follow-up questions is to analyse the changes in personal world-view and attitudes as a course of changes in professional development during the period of three years after the first interview. This aims at finding the answer for research question number 3 (Follow-up questions FUQ 3.1 – 3.5). The questions were also intended to give more data to the research questions number 1 concerning personal adoption process (Follow-up questions FUQ 1.1 – 1.2) and research question number 2 concerning the efforts and individual strategies of the EUAD activity (Follow-up questions FUQ 2.1 – 2.3).

The follow-up questions aiming to research question number 1:

FUQ 1.1 If you have changed your job, what was the main reason for it?

This question aims at getting more up to date information for the original reasons for the EUAD activity. Especially, when the person has changed his or her job to an IT-professional, s/he is more willing to express the real reasons for that.

FUQ 1.2 If you think of the time of the first interview, what has been happened since that? What is your job at the moment?

This follow-up question aims at getting a description about the circumstances after the first interview and how the EUAD activity led the career of the EU to the situation as it was in the follow-up interview. Replies to this question also give information to analyse the consequences of the EUAD activity for the EUADers.

The follow-up questions aiming to research question 2:

FUQ 2.1 How is your area of interest changed? Are you still interested in developing applications?

We want to know the real nature of the motivation toward the EUAD. Has the the EUADer maintained the activity also in the case when the contents of the work and working environment have changed, and perhaps, when the significance of that activity for the work decreased.

FUQ 2.2 How is the IS environment changed? What tools do you use at the moment?

This question looks for the personal career history of the informant. In so doing we also get information about how the changes in the IS environment have affected the work

content and attitudes of the EUADer. The question is also supposed to show the consequences of the EUAD activity and also to reveal more information about the unexpressed motives of the informants.

FUQ 2.3 How do you gather information at the moment?

This question aims at the same purpose as the question 2.2 in the area of gathering information.

The follow-up questions aiming to research question 3:

FUQ 3.1 Tell me about the changes in the organisational environment?

This question looks for the changes in the organisational settings and styles of management. If the person is not satisfied with his or her company/management, s/he may express it when answering this question.

FUQ 3.2 What are the impacts of the EUAD activity on the job contents and professional career in the long run?

This question aims at getting the informant's own judgement about the EUAD activity. This question is very important when drawing the final results about the EUAD activity of that study.

FUQ 3.3 Did you attend seminars, meetings, courses, etc? Do you have any new contacts?

The purpose of this question is to get more data about the links of the EUADer as in question 3.3. We also want to know if the informant has been searching and creating new contacts during the time since the first interview.

FUQ 3.4 What do you think about IT as a resource in your job? How important it is to succeed in doing the job?

This question aims at the same purpose as the question 4.7, but in a more general sense. It also exposes the informant's attitudes toward IT: the more motivated the informant is, the more important the IT is expected to be in the eyes of the informant.

FUQ 3.5 If you were an IT manager, would you allow your subordinates to develop applications of their own?

This question is intended to let the informant wrap up EUAD activity as a whole. Seeing the context of the question the answer of the informant will be given based on his or her

own experiences. Such being the case the informant actually evaluates his or her own EUAD activity. Therefore, this question reinforces the previously given data.

2.3.3 Methods to Interpret the Data

The analysis process was based on the guidelines of qualitative research methods (Strauss & Corbin, 1990, Sandelowski 1995, Stake 1995, Miles & Huberman 1994). We try to create a description about end users as application developers. We draw a profile of each of the interviewees and compile a holistic view about each of the informants. The Grounded Theory (Strauss & Corbin 1990) guided the process of finding concept categories and relationships among them.

The main idea of the analysis process was to find out what the informants did or were said to have done. The informants were also encouraged to express their opinions, ideas and plans for the future. The reason for this was to shed light on the conditions, contexts and consequences of their actions. Special attention was paid to the separation of the analysis and interpretation of the data at the very earliest stages of the analysis (Sandelowski, 1995). At the early stages, the view tried to avoid interpretation and concentrate on the analysis.

The analysis and interpretation process can be divided into six phases as listed below (Kvale, 1983). We completed the first five of them. The interpretation of the actions of the informant is fundamental. The concept of 'life-world' is here materialised as being in the organisation as a staff member. This is expected to be a concrete and useful method for understanding staff members in the working practice.

During the interview we tried to keep the different views and levels of interpretations in mind. The process of analysis used follows the steps by Kvale (1983):

The interviewee's view:

1 The interviewee describes his life-world
2 The interviewee discovers new relations and meanings

The interviewer's view:

3 Condense and interpret what the informant says
4a The level of self-understanding: What the interviewee him/herself understands as the meaning of what he describes
4b The level of common sense: Draw a broader understanding of the meaning about the theme

4c The level of theory: Draw a theoretical interpretation. In this phase the data is interpreted through a broader theoretical context
5 Re-interview (we conducted this as a follow up interview)
6 Involve action (not conducted)

In the first stage of analysis the organisational data were studied and labelled with as many concepts as possible. This stage was intended to cover the first two steps. Every relevant act that the informant said to have done was given a name. The focus was on how the interviewee describes his "life-world". The opinions and perceptions were listed, too. The purpose of this step was to interpret sentence by sentence what the informant is trying to say. One list of categories was made for each informant. The categories varied depending on the informant. An example of the categories found is presented in Table 2.6.

Table 2.6 *The Analysis of Data: Possible Category/Property Names and Values (Example)*

Interviewee	**Person A**
Possible category/ Property name	**Value**
Actual job content	Operator, Supervisor
Education	Technicial, CAD
Hardware environment	Mainframe
Requirement	further process of data
Tool	spreadsheet, database, macro language
Perception about the usage of EUAD	it makes the job easier to the others the reporting will be more efficient
Motivation to begin EUAD etc.	own interest

We wrote a short story about each informant. This was done in order to have a more holistic view of the working history and adoption process. These stories are presented in Section 4.2. Preliminary analysis of the categories was made from the labelled actions. The concepts, which are similar, constitute categories with common properties.

A summary of every interview was written to get the central idea and meaning of the phenomena for each person as a whole. The categories found earlier were in the background to shape the interpretation of individual cases. Every interview was analysed using an Event-State network (see Miles & Huberman, 1984 and 1994). It helped to get the basic idea about the story of the EUAD. This analysis covers the phases 3) – 4 b). An example of the analysis is given in Figure 2.4.

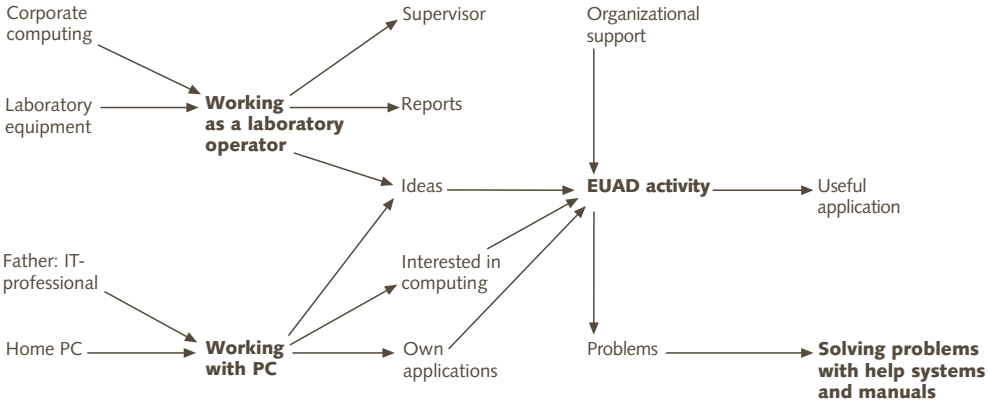

Figure 2.4 *The Event-state Diagram for Person H Laboratory Staff Member, Develops All Kinds of Applications (Example)*

The concepts in bold face depict significant activities of the EU in the light of this study. The regular face illustrates factors or events that the informant mentioned as a reason or consequence of the activity in case. The arrows indicate the direction of the relation.

In this Figure above (2.4), the informant mentioned as reasons for his working with PC was the fact that his *father* was an *IT professional* and they had a *Home PC*. He has also got many ideas from working with a PC at home and *working as a laboratory operator*. He has got more and more computer related duties when working as a *supervisor*. His *Working as a laboratory operator* consists mainly of operating with *laboratory equipment*. He collects data and controls the processes of micro-mechanical research work. The *corporate computing* systems affect his work quite a bit, because the results of the measurements have to be entered into the corporate computing systems. His work includes a lot of producing *reports*. He gets lots of *ideas* of new systems, because he is very *interested in computing*. The interest originates

from his childhood. His *father* is an *IT-professional* and he also has a *Home PC* since he got the first VIC 20. He *works with his PC* by creating *own applications*. He creates his own applications off duty hours. This extra work at home with the PC and the new application ideas in work characterises his *EUAD* activity. The *organisation* that he works for also supports him. The result of this is new *useful applications*. He also has *problems*, which he quite easily solves with the help of *manuals* and *help* systems.

3 Description of the Informants

In this chapter we draw an overview about the data and about each of the persons interviewed. We shortly describe their working environment and the contents of their own work at the time of the first interview. The individual process of the EUAD activity is described. This covers the personal reasons for starting to develop applications as well as the implications of this activity to their work contents, to the perception about him/her self as a worker and plans about the future. The personal descriptions also cover the career status and environment more than three years later, when the second interview took place. That is supposed to give a longitudinal description of his or her work history.

3.1 About the Subjects

The research data consists of two series of interviews of ten persons. The data of the first interview were gathered during spring – fall 1997. Six of the persons interviewed were from the Lahti region and three of them from Helsinki and one from Turku. Six of the persons were less than 40 years and four of them over 40 years old. All the interviewees were less than 50. Almost all informants (9) were male.

The educational background for six of the persons was technical college degree. Four persons had an academic degree. Two of them have studied natural sciences and two have graduated from a Business School. Most of the person's (9) were from large (over 500 employees) organisations, where the staff members were accustomed using computers in their work. Three of the academic people were working in research or education oriented organisations like educational institutes or historical archives. One of the academic people worked for quite big industrial company as a project manager. The companies present the food, forest, power supply, broadcasting, and machinery industry. All participants had earlier experience on computers.

The second interview took place more than three years later. Six of the persons had left their original job in order to start a new job. For five of those persons the new job was an IT profession. Three persons also moved to another geographical region because of the new job.

3.2 The Stories of the Interviewees

In this section we give a short description of the stories and work contents of each of the informants. Each person has a history of his or her own, consisting of the early experience on computers at home and school as well as of the first trials on using computers at work. Although they all have the same desire to utilise computers, they still have different backgrounds and personal reasons for that activity. The stories are supposed to work as an orientation basis for the analysis and conclusions in the following sections.

Person A

At the time of the first interview person A has worked for six years as an operator an controller in a power plant company, three years as an operator and three years as a supervisor of the control systems. Her work comprised of "*All kinds of maintenance, so that they do not have to write things on paper pads*".

The control system, which she operated, produces data, which she collected into a microcomputer and processes it with spreadsheets and database programs. The purpose of the system was to help the other staff members to enter data into the computer and get the information they wanted. She thinks that it is easy to first put the data into a spreadsheet program and into a database. The tools used are Lotus 123 and Paradox. She uses macro language to automate everyday routines.

The work itself causes a lot of paperwork. She also develops systems for use of her own because her duty is to take the seasonal statistics from the database. She has developed a database program to collect the data. The main aim of the database system is that the users can enter the data into the different places in the database. After that she monthly runs the statistics. She does not want to have any paper sheet in the manual files, everything will be stored into the computer. She thinks that a centralised database would be an ideal solution.

Person A was originally interested in electronics because she used to work in that kind of job. She attended a course in CAD design and is graduated as a technician. In the first year at the school, she did not understand very much about the Basic line code studied. After an industrial placement she studied Pascal and C. But she thought that she did not get much out of it. As a matter of fact, she did not like programming even at the time of the first interview. At school, the short programming course was not very interesting or useful, but at the moment, because of this new 4GL programming language, she has very easily managed to develop simple programs. It is such strict and

long-term work that the use of software packages and their programming possibilities are easier. She thinks that she would like this kind of work if she just got enough time for it. She would like to get more support for her activity.

The reason to start the application development was the perceived usefulness for the others:

> *"...since when you always did the same things, it made it easier in the way, that the function was behind certain keystrokes … In other words, they didn't actually have to know anything about the program, only to know how to start it and what data to enter."*

The impulse to start the application development was totally based on the interest of her own. The required skills and knowledge she had were based on her technical education and from short IT-courses, which she had taken during her leisure time. From these courses, she had got ideas, which her boss had accepted. Her first application was a database of customers. She noticed that everybody had the same manual customer file in a drawer. Later on, the Lotus Notes system included the customer database, too and she was very happy to have been able to complete this application.

Regarding the problems of the EUAD she thinks that isolation is the most apparent. New things to learn are coming all the time. At the moment, Visual Basic and the relational data base system have to be learned. On the last course in Visual Basic there were lots of things to learn. She should have more time and a group of people to exchange information with. The user requirements are changing all the time. "*You never know what somebody wants*". The problem is that when there are so many new things continuously appealing, and they are somehow related, the whole system will become unorganised. To perceive a total view of the problem area is maybe not a problem, because you have to know by yourself what you want. The programming will not be a big problem because of this Visual Basic. One problem is how you manage with those areas when you have many different things related to the same program.

Recently more people have become excited about application development, but those people are not much help because they know less than she does. Generally, people are not very helpful:

> *"In this company we have that kind of a problem that, here everybody has knowledge, but we cannot utilise this knowledge for the use of others, or if you ask something, it is difficult to get an answer. I don't want to do that kind of task that somebody else has performed."*

Her own work contents have changed a lot. Now all the data are in the same database. Her job here is now ending and she will change job to start a job as an IT-professional.

During the second interview she worked as an IT specialist in the headquarters of her employer in the IT department consisting of three employees in addition to the IT manager. She is now responsible for the operational systems of accounting and administration in the company level. Her work consists of running and developing the systems of reporting. At the moment she is developing the systems to work on the Internet. The system development is mostly maintenance by nature and not very much programming.

"Let's say, that I have fixed, made small additions, and changed something…"

She describes her work more likely as an intermediate between the users and system provider. She thinks that her earlier work as a user of control systems as well as her technician education helps a lot in her present job.

She is still interested in software development. She continues her studies in computing in a department of technology at a polytechnic level. She has also attended short courses at her work. She would like to have attended a more advanced course in software development too, but the company did not allow her to go because the course would have taken three months off her office hours and she also had duties to do in the office.

Person B

At the time of the first interview person B was working as a technician in a power plant company. His work mainly consisted of calibrating gas supply equipment. He has been interested in computers for a long time. He does not have programming experience from school, but he bought a home computer (VIC 20) at that time. He says he likes programming and has been interested in it since he bought the home computer 15-20 years ago.

The ideas of creating own applications came from the need to diminish paperwork. The aim of this application is to gather data from the gas meters located throughout the region. By using a portable PC the technicians can collect the data and move it into the network database afterwards. They have about 300 gas meters and this system helps to gather all the data and print the reports for the meetings. The other staff members have been in agreement with his activity.

"It is not easy to say whether this is a hobby for me or not, I can't do anything else, actually."

He started using Access from scratch. It is quite easy when you do not have to write so much code. At the time of the first interview he could build better tools for himself. The most recent version of his program was under construction and he used Access for it. The first version was made by Lotus-123 macro language. One version was made using Excel. The application is still in use. He also develops application at home, because his wife has a small sales company.

Sometimes Access causes problems because the way of approaching the problem is different. The actual method for him is the 'trial and error'. He also thinks that the Help-System is very useful. The manuals and Internet are used, of course. He is also accustomed to using procedural programming languages.

He thinks that, in the future, his work will be computerised. Furthermore ideas for new applications pop up all the time.

"We also have test equipment for the meters… I also have a program for that under development."

He does not have any problems with the employer. His boss has a positive attitude toward his activity. One of the problems is isolation. There is no one to ask advice from. He does not have colleagues to ask for advice, because so few people are working in this area. He hasn't attended any formal programming courses either.

One problem is the limited time available. The programs should be well tested before taking them into use. Besides, the actual job has to be done. He does not think that he is going to be an IT-Professional in the future, because they are such 'hard' professionals and he wouldn't be as good as his ego requires.

After three and a half years he works furthermore at the same job. The work content has been changed in the way that he does not have to travel so much in the field as he had to do earlier. Nowadays the work consists more and more of controlling the gas meters from his workstation.

Besides his work he has been studying application development and also continued developing the systems by making them better. He also started to continue his studies in application development in a Polytechnic.

"Due to the nature of this work I have...well...mainly improved those applications that already existed at that time…" (during the first interview, author's note)

He likes to use Internet as his arena for gathering information and also ready made software components. He thinks that

> *"It is useless to invent gunpowder again… when someone has invented a generally useful piece of code, so why not use it in my own programs".*

Person C

At the time of the first interview person C has worked for an historical archive. His title is a researcher, like all the others working there. Originally, his work consisted of many different tasks. He is specialised in photo archives.

In university he has studied geography. He has also attended some IT courses. He thinks he will manage with programming since he has the core idea of it.

The development work started in 1987 with the introduction of micros begun. The archives got an allowance to buy a computer and software for the use of customers to search documents in the archives. He was given the task to study this task and acquire a computer and software for that purpose. He started the work by interviewing a construction engineer who was in the same situation as he was. He also looked for a developer among the IT-professionals, but it looked like nobody had the required competence to work with microcomputers at that time.

> *"I started to look for that kind of people, who I knew, had landed an IT job… They said that they did not have the competence for that job... I would like to be the bridge between the archive function and this. I have tried to point out to my boss, that OK, we are able to do almost everything, but let's think … Then I realised that it is me, the developer."*

He started to implement the application. He read manuals at home and started writing program code using Dbase3. The first version consisted of lists and that the users could browse on the screen.

> *"Of course, my friend had a point, and I purchased this Dbase3. I begun to do it by describing the system. Earlier it was so that first the problem was analysed and then it was implemented on the computer. I started the system work by sitting down together with the staff and started talking about what this computer is all about. Feedback was exactly zero. ...Then I realised that the task has to be done in a reverse order. First you have to do something".*

He had the vision that the customers could browse the documents on the screen by themselves. The computers still do not foresee the people involved, but on the contrary,

increase the work. Also all the staff members should take part in the system work. Later on, the staff members started to give feedback *"more than needed"*. He also argued with some persons a lot. His boss was very supportive even if he was a *"fundamental humanist"*. Most of the others did not dare to say anything against because he is *"so quick-witted that they easily play the second fiddle"*. Some were against him and others were saying that the electronic documents are the intermediate stage and the final stage of the task is the documents on the shelves. He said that the papers are the intermediate stage and the final stage is the documents in the computer. Later on his vision came through in the second version of the application.

The development work has changed his work a lot. He has given up his job in the photo service. At the moment his workload is too high. He has done this programming work in the evenings, and he has had an allowance, too. He would like to do all kinds of tasks. He should have more time for this computing.

"I'd like to be an archive professional specialised in computers."

He sometimes has problems with manuals because they contain errors. The Clipper User Group has had good meetings and courses. In addition, some of his friends have helped. The vendors are not very helpful, they just want to sell computers and think that the users should be forced to use them. This is absolutely wrong. The people have to be made motivated to use computers before the computers are carried in.

In the future he will have to rationalise some other tasks away and concentrate on computing. There is a lot of work to be done. There is also a great need for user training. The organising and administration of the data base for permanently preserved documents will be a big task. There will be documents that are not printed anywhere.

"We need a structured system controlled by the state like the one we have in the archives of movies."

He has a lot of quite strong opinions about different areas of system work, which were expressed boldly.

"This computer seller said that it is the IT-department that decides what the people use…the hardware is just brought in and the man starts to use it. I said: WRONG. Absolutely WRONG! We discuss the problem with the dumbest idiot about if he or she is willing to accept it and after that we get the hardware."

"The people who do not know anything about computers fancy Email... I have tried to explain that we have had this great network since the 1600's, the postal

system. If you put a big pile of A4 into the post today they will be in Rovaniemi the next day."

After three and a half years he is still working with the same information system for retrieving documents of the archives. He started a joint project with a partner archive in order to implement a new system running on the Internet. Unfortunately the partner did not have the time to work with the project. He decided to continue the project in his own archive.

This project to implement the systems to run on the Internet required a big change in the old systems. He had to turn down the earlier designs based on Dbase3.

"Well… I was thinking little by little in another way. Anyway, the Internet is not an arena for entertainment and pornography. It is really communication… I was hesitating, but when I turned on, I turned 180 degrees and I came forward with a proposal that lets us throw out all these fucking old systems and create new ones."

He purchased a quite new exceptional server system and trained himself to create code with it. The system is now almost completed and it is installed on the Internet.

At the moment his job consists totally of software development. He even thinks that he has to delegate some of the functions to others and rethink what he does himself.

"I think that I should be between the running of the archive and the computer. This server task is my job. But when the server does not work, I call somebody to come and fix it."

Person D

At the time of the first interview person D was working as a technician in a broadcasting company. He has studied information technology alongside his job at a college of technology specialised in computers. He graduated as a computer engineer. Getting the appropriate skills from this new education, he has started to develop applications, which serve the company at nation-wide level.

Earlier it was electronics that he was interested in, but when he bought his own computer, programming started to fascinate him. He then went to an adult education centre specialised in computers and there he got his basic skills in computing. He started the application development when he improved the skills in the school.

"In this job, I have already prepared applications with C language, which serve our operations nation-wide. I became so enthusiastic, because of the substantial

capability acquired at school. The needs in the workplace caused it, that they were taken into use. There has been a great drive to do this…"

His activity was noticed and he was asked to do applications for several purposes. The applications developed serve the company in technical computing like collecting and analysing meter results. He also developed an Info system for the Radio Museum using Visual Basic.

He felt that application development is quite easy when he knows the problem area, which he has already been involved in for years. He has many ideas of how to develop new systems. He uses manuals, Help-systems, school materials, old friends, Microsoft technical assistance, colleagues, and textbooks about Visual Basic. The manager is supportive, and his colleagues took a neutral attitude towards it.

"Well, there is nothing special here, of course somebody has said something like 'How do you get the time', but there is actually no problem with that."

He had two different duties to do: the work as a technician and as an application developer.

At the second interview he had moved to the headquarters of the same company and started to work as design engineer in the same area. His work consisted of consultation, training, and to a great extent, systems development in that area. The tools used are Visual Basic and the Access database program.

Later he was promoted to the position of head of the department. The next person who is going to take over his duties as design engineer will also continue the work as systems development as well.

Person E

At the time of the first interview person E was working as an electrician in quite a big company. He was then driven to the maintenance of the software systems by making the things to be done easier for the users. The company then asked him to start a job as a computer assistant. Because he was interested in that kind of task more deeply he thought that programming was one of the things to start with. He has attended a Visual Basic course and also completed such courses as NT4 technology and office tools. He also thought that the world will be more and more computerised and one has to follow the trend.

"I have two children, 9 and 11 years old, and I think that the earlier you make them familiar with computers, the better they get on in the future". "... of course, the willingness to develop oneself in the sense that one should always have challenges."

He mainly uses office tools. He also has the intention to start using Visual Basic on these tools. He thinks that he needs to go through these exercises of Visual Basic first.

"...well, I have an idea to start developing such tools, because the number of our staff has diminished. Everybody's workload increases..."

In the process control system, which was quite out of date, there exist several opportunities to where he could apply his skills by writing code in it. He also has an idea of developing a system for the new employees to get familiar with the company. The help system can be implemented as a hypertext. Another idea concerned the logic of electricity systems. This application can be used in his job.

He does not actually know which of the two is more fascinating: the maintenance of the network or the application development. He thinks that the networking is quite an interesting thing.

"This is a nice job in the sense that I do not have to choose whether I focus on this task or that one. I can put my hands on all of them".

He uses Internet and Help systems to get the information needed. Because his company is so big, there is an expert for every task. They also have an Intranet system and many active and helpful users in it. Unfortunately, it can happen that all persons are so specialised that it becomes difficult to get help.

The application development takes so much time that the office hours are not enough.

"If I go to the office, and just sit there for one or two days thinking how I go through this, because there will always be problems, I think that the bosses here will say 'sweetheart, could you start working?'."

He likes his job very much and he is especially enthusiastic about the general image of the computerisation.

"You have to do the task, everything that is related to electricity or computing is somehow sporty" ... "This is my personal opinion that these computing tasks should always be done with a certain playfulness."

In the future his company will continue installing new software all the time. The problem is how the independent initiative can be engaged. In the future, the EUAD will be more of constructing applications from ready-made components, which you can download from the Internet.

During the second interview he had moved to another company and started to work as an IT manager in a company in the wood industry. He is proud of getting the job, because he got picked from a group of 61 candidates despite of the fact that he had only a practical experience and not very much formal education. His job mainly consists of supporting end-users and running the company-level IT systems. The work does not include programming very much.

> *"In IT business, especially in the general administration were I am working, we deal with the problems of the users as I did in the previous company… It is that kind of customer service anyway."*

He works with the local networks and Internet. The tools that he needs in his job are mainly the same. He goes to seminars and meetings to keep his knowledge up to date.

Person F (excluded)

At the time of the first interview person F worked as a secretary. She was active in her job and wants to enrich her job by applying new information technology. She uses office tools like word processing applications, but does not actually develop new applications. That is why she was excluded from the sample.

Person G

At the time of the first interview person G worked as a lecturer in a commercial college. His actual job was to give lectures in accounting but recently he has got more and more administrative tasks to do. Among other things, he has been made responsible for making the course schedule plan and sorting out student groups for optional courses. He started to develop applications for these areas. He mainly used Excel and Visual Basic. The usage of computers is a very essential part of his job.

The application development activity started when he had to organise the students of different options into groups. When he saw the others doing so much paperwork on it, he said that maybe this could be done with a computer.

> *"I had an impression that it is possible."*

He actively took part in the selection process of student into the specialisation lines for which the application was intended.

> *"If I have any kind of task including a huge amount of data, I will not process it manually. If I know that it is possible I want to try it."*

He selected a tool, which he knew to be the best. For him the main purpose for development activity is to "*maximise laziness*". The ideas pop up from the work itself and he is not going to invent them by himself. Anyway, when the system is completed you have to start it over. The system will never be completed. About the motivation he says that:

> *"Well, it is just work, you never get so enthusiastic about it."*

This application development is a lonely man's work. You do not get support for it. The users do not even know what it is all about, but when they see the results they want more. The major problem is that he does not have a programming background. He has to study the basic program structures first. Anyway, he thinks that he got quite well into it. He browsed the books. But he does not have enough time to spend on this work.

His work has changed during the computer usage. He can use this knowledge in his teaching work. He thinks that in the future, all basic tasks can be performed with software packages and you can develop your own applications for separate special tasks.

After three and a half years a part of the applications created by him are still in use but he has laid down the EUAD activity as creating new applications. This is because of the new school systems that now include many functions with shared databases taking care of all these tasks as a whole. He has also applied the knowledge in some small projects. He still thinks that

> *"…you always meet the problem that somehow you are ahead of the time compared to the real world".*

Nowadays he has mainly applied the knowledge to his courses in accounting. He has met some problems because not all the students get so enthusiastic about the topics of this kind. He thinks that according to their own interests you should encourage the students to create their own applications but in the work place, not all will have the capability to do that in practice.

> *"In spite of that (the problems met with his students) they had good ideas… but it would be shut down very soon in their own working community… maybe it is that people fear for the mess that it can cause."*

Person H

At the time of the first interview person H worked in a laboratory as a supervisor. He worked in a team to develop and supervise the process in micro mechanical research work. The work consisted of maintaining laboratory equipment and its software, analysis and reporting. Besides his daily duties he has a second job that deals with gemstones.

The enthusiasm for computers came from his home. His father worked for a computer company and always had the latest version of computer hardware systems. The interviewee began to make his own systems and now he has developed solutions, not only concerning his own work, but also for others outside the company.

> *"I have developed systems where ever I happen to turn my finger to. I have thought about what kind of systems I could do". "In my work…it has begun from the need that it is not fun from day to day to search for data from the same place and then print the same kind of graphics". "Well, in a way you start to get hooked. When you have some idea you want to implement it. In many cases, a project is such that I first implement it and after that I start to think about what it has been created for."*

He develops applications just for fun.

> *"Always when I realise that there is a case for which you could develop a calculator or something…"*

In his actual job during the first interview he developed a Statistical Control Program, which analyses the process and alarms when certain values differ from the standard values. For gemstone research he has developed a program for defining the type of gemstones based on the known features. He has also developed an application for watchmakers to store data about maintenance and fixing. He first developed it and offered it to the customer afterwards. This inter-organisational activity is his second duty and 10-15 percent of his yearly income comes from it.

On the one hand his motivation for developing applications is to improve the quality of his work. He tries to get his work *"more punctual and precise with the help of computing"*. On the other hand, he does not like to do manual paperwork for hours. He also likes to find solutions for new areas. The programming is a lot of fun, but it gives satisfaction when he sees the program working.

Most of the information needed he gets from the Help systems and manuals. His father is the principal professional informant. He also has friends to turn to, but he thinks that he is the one to whom the others turn to.

In the first interview he said that on the one hand he does not want to switch to being an IT-professional, because his own profession is so interesting and versatile. His company was investing into a new factory and his duties will be totally related to it. New challenging jobs are to come. On the other hand, he thought that he couldn't be so good a programmer as those, who have the formal education.

Before the second interview was taking place, he had established a software company with five other shareholders. He also has continued to maintain his applications of the previous workplace.

He said that his job content in his previous workplace began to be more and more software development. He also had the freedom to steer his work in that direction. He built measurement equipment and created software for them. The boss of his own department felt very positively about it.

> *"I was a member of the process development group that needed that kind of software."*

Sometimes he also had *"tough discussions"* with the IT manager who did not like that kind of activity. The IT manager wanted to follow the general company policy according to which software development should be under the control of the IT department. The real reason to start his own business comes from family. All his family members are entrepreneurs.

> *"Well, on the one hand a reason (to start own business) is the craziness in the family…One other thing is that, as you (researcher) met the staff of our company, you can find many relatives and friends who have done this work earlier. The idea to start my own business has actually been in my mind five years already."*

The company mainly works in the area of developing Internet applications. They use Visual Basic and also Delphi in a slight extent. They actually have tens of application development environments, image processing applications, servers, and computer networks as well. The work content has become even more challenging and versatile than it was during the first interview.

Person J

Person J is a graduate engineer in logistics and worked during the first interview as a warehouse manager. The company later merged into a bigger company, which changed the information system environment.

He was interested in programming already in his school days. The curriculum did not have very much programming at that time, but he bought a laptop of his own and started to learn by himself. He noticed that he was always a little bit ahead of the others and could also help his school friends. He did not personally receive very much of the teaching.

After school he went to work and started as a truck driver. He was then appointed vice-director. He considered the stock-control system out-dated and started to develop a new one.

> *"Of course, I was interested in programming, too … the reason was anyway … that these tasks can't be done in this way… it irritated me because the program was so slow."*

Firstly, he did not talk about his system development activity to anyone. When the system was completed, he told his boss and asked if it were possible to get some compensation for the work he had done. In the beginning they were against it. They did not like activities running which they knew nothing about. But when his boss noticed that it was useful he got the compensation. The financial manager also became angry when he heard that Person J was doing projects that he did not know about. A computer expert was on his side, but later on he held a go-minute meeting telling him that that kind of programs should not be done. When the time went on the program was accepted into use and he got the compensation, too.

The reason to start this development was because he was interested in programming. He had done the programming work at home, and during the time when he was not busy. His principal tool is Delphi and he thinks that it is very good and is becoming more popular. He started to learn it from scratch. Before that he had some experience on Visual Basic. The system implementation work took about two months. After the merger he started to implement another program which took about four months.

When he started programming he bought a textbook about Delphi. He also regularly buys computer magazines. The principal source of help is the Internet and Newsgroups. He has asked for advice and downloaded components. He thinks that the people in the Web really give the answer if the question is formulated in proper form.

Recently, when the questions have been more difficult, they have apparently not been able to answer.

He has tried to make a plan for his work and analyse the problem area before starting the implementation.

> *"Firstly I thought that I would make a clear description about what they do in the store and how the program should function. But I could not do it, because I then noticed that now we are dealing with a module, and I still don't know how to implement it. Then I had to try I … and the task with the description was cancelled."*

He likes to solve problems, but it is the coding process that he does not consider so interesting. Regarding his future, he does not have any clear plan or vision. He thinks that he may work with logistics. He cannot actually say whether he is interested in programming or not, because he is tired of programming at the moment.

> *"I don't know what then when some time has gone by without me doing anything. It can happen that I will be eager to do something new."*

After completing the system he was promoted to head of storage and he also was allowed to always do system development when he has spare time in his job. Anyway, he did not regard his job as challenging enough.

> *"…if I wanted to do something more challenging than the work at the storage, I should have found a software to create, or another problem to solve, but that kind of problem was not at hand."*

If that were not the case he would have stayed in his job. He applied for a job as a systems designer and left the company. Before he left, they had some talks about integrating his job with the IT department but those plans did not come through. Therefore, he applied for a new job in a software company. In the last months of his job he also had to spend all the days that was left as his vacation. He informed his employer straight after he started the vacation. Even though he was on vacation, he worked for his company at the time. For his last task, he documented his application.

He is now very happy with his new job in a software company. Now he can do what he really likes to do. He can attend computer courses two days a month. His job consist of application development as a member in IT projects. He uses Java programming language. At the time of the second interview the project was already in the update stage.

Person K

Person K is graduated from a university emphasised in technology. He took part in some programming courses but they did not interest him at that time. His final diploma work concerned the use of knowledge based planning systems. Its focus was mainly the use of software, not the IT itself.

His background as an EUADer dates back to the times of microcomputers in the 80's. He worked as a trainer in the machinery industry. In order to automate routines he started to develop applications.

> *"… we run these spreadsheets a lot, they were quite big…There were some routines which had to be done every month."*

The use of computers started step by step and expanded to complete applications. The first application dealt with business graphics presentations. The tool used was Lotus 1-2-3.

The main reason for the EUAD activity was to improve the working procedures. The work in the old way just seemed so "stupid". He wanted to find a better solution.

> *"It started with just very small things, firstly I thought of a very small thing, if that could be automated somehow. Then step by step it began to expand…"*

During the first interview he was landed to work in accounting. Later on he became a project leader for the developing information technology. He uses manuals as the main information channel. The use of Help-Systems remained quite small, because at that time they were not very useful. Because he did not have colleagues to ask help from on EUAD, he personally had to become an unofficial Excel support person.

He thinks that the EUAD, especially programming, is quite complicated for an ordinary user. The threshold to begin is much higher than just starting to record macros. If you do not know anything about programming, the application development activity will be reduced significantly. When considering organisational computing the systems should be quite small and be linked to the work in hand. The link to organisational computing is important too.

The EUAD also causes problems. The learning process takes time and it is difficult to find support. It enriched the work later. The applications developed by him were still in use when the first interview was taking place. He thinks that it is fun to prepare those applications but they must be useful, too.

At the time of the second interview he still works as a consult of business management. He has not done any EUAD at his job. The primary tools used are Excel, World and other office

tools. He thinks that those tools that he has learned once will also be applied in his work. He has done application development at "*some level*" with his clients. He thinks that there is some need to develop these tools, but it is actually not his job to develop these tools.

Person L

During the first interview person L was actually a student, but worked as a researcher in the School of Economics and Business Administration. His work consisted mostly of writing. He used micros to perform statistical analyses for his research. He also run his business by carrying out small IT-projects for companies.

He has been dealing with computers for a long time. His father bought a Vic-20 home computer when he was twelve years old. He thinks that it helped, despite many other hobbies at that time, to see how the systems work.

The reason for developing his own applications was to reduce his workload because he has to process a huge amount of data.

> *"The engineer wants to build a machine for a task in spite of the fact that the same task could be performed much quicker manually…quite the opposite, when I had one case, I wrote an Excel function. I had a number, which had a point as it's decimal separator and the Finnish version did not understand it. I wrote a function, which converted the comma to native comma… So I try to keep it very small…"*

In his work when he begun to enter empirical data into the computer, he developed a relational database consisting of individual tables. He developed functions in order to make it easier to enter data. He is specialised in Microsoft Office products and has also noticed many places where these tools can be used more efficiently. He will more likely call these private applications in bank business as an automation of routines. He considers himself as a "power user" or a link between the computing people and users.
One of the problems is how to find ready-made solutions.

> *"Very often I have the feeling that I am building again something which has already been done... it is easy to search semi-finished solutions from the Net, but they … are often for a very specific purpose."*

He thinks that the number of documents is too large. The work will easily change in the way that you just copy these documents into your workstation. He thinks it is a great advantage to him that he is able to search the information needed. He knows what keyword to use.

The use of computers has not changed his work significantly.

> *"... they are often quite straightforward things, which require some kind of spurt…I see that here I have time to put a thing through."*

The other people in the office took up a positive attitude towards his activity. Some of his friends, who have a business of their own, often make offers of all kind of tasks. He thinks that it is better to give them up because the business partnership with friends can easily break the friendship.

In some cases, it is strategically very important to be able to perform some tasks with a computer and on the other hand it is a cost saving factor too. He thinks that he is in quite a good position when having the ability to use computer.

> *" … in our department we do not teach very much computing… we have managerial view in teaching…but it gives a practical view for my research work."*

During the second interview he works as a consultant for a company that sells business software productions. He does not have done any personal software development since he left the School of Economics and Business Administration. He says that his work career does not require that kind of activity. He says that he has to think the things as a whole.

> *"Say, I see my area somewhere between the IT administration and business … I furthermore take care how IT can support business."*

He represents software products that are used to analyse business data. The software gets the data from information systems of their customers. A typical case is to analyse the value chain or the time needed for different business processes. His job consists of solving problems of their customers.

> *"Actually, I do not think that something fundamental has been happened. However, I still look how to make use of IT in business."*

He is still interested in computing in the almost similar way. He thinks that now, in the contrary of the previous times when he had to think what to do with Excel, now he has to think what to do with a certain business area.

4 Data Analysis

In this chapter we present the findings and conclusions about the data. We analyse the EUAD as a process of personal development at work. The EUADers profile and his or her actual work contents at the starting point work as the initial state. The process is described through his or her motivation structure and its links to other factors of that activity. The final state of the EUAD is realised through the consequences in the career and work contents of the EUADer.

The process is described as follows. Firstly in Section 4.1 we draw a profile about the EUADers' personal history of computer experience, sell-efficacy, commitment, attitudes, and what kinds learners they are. Next we describe their work contents in Section 4.2. It is for understanding the context where the EUAD activity takes place. In Section 4.3 we draw a picture about why and how the EUADers develop applications. We try to find a pattern for the motivation structure and link it to other factors like intensity, tools, methods, communication and types of applications developed. Finally, we analyse the consequences of the EUAD activity to the professional careers in Section 4.4. This analysis is based on the data of the second interview. Especially we try to analyse the reasons for changing job to IT professional and describe what kind of persons are motivated to EUAD because of seeking an IT job.

4.1 Personal Profile of EUADers

In the first research question we set the goal to find out what is the EUADers personal adoption process like. Consequently, we wanted to know how and why they started the application development activity.

4.1.1 Personal History of Computer Experience

The personal history of computer experience may play a central role in general causal conditions (Straus & Corbin 1990 pp. 99) for the phenomenon of the EUAD. This is important for understanding the personal adoption process about how and why the persons under study started to develop applications. We asked the informants to tell about themselves and how they started the development activity. The personal history tells us what they have done with computers.

Nine of the persons had some kind of experience in computers from their childhood or school. Usually it is a home computer or a short course in programming at school. All the informants spoke quite much about their personal experiences on computers and programming at school or in their childhood at home. Only one of them (G) did not have any experience in programming or any home computer. Although the programming courses were not very extensive or useful, they must have had some relevance to the persons, how they perceived their skills in programming. They quite likely mentioned the experiences in their programming studies not depending on their success in them or attitudes about their usefulness. Although some criticism about the teaching methods and some underestimating assessments on the use of their home computers were expressed, their experience with the computers seemed to be positive.

> *"There the first year passed so that we were working on the terminals ...it was terrible …we made some lines of code and did not understand anything … however, when you see, then you know that oh this is C code and this is Pascal and…" (A)*
>
> *"I remember that when we learned the algorithms ... that was the problem in the beginning, what hell! …But when I realised that it is just the simulation of every-day life through computers ... anyway, the training still exists in my head…" (C)*

The interviewees were generally dynamic and acted with several activities. They have had lots of hobbies and also shown extra activity at school. Six of them (B, C, E, H, J and L) had computer related hobbies or worked or studied at home. As shown in the quotes above, their interest is not actually focussed only on computing. Especially those end-users who were the most active (C, H, and J) were also interested and committed in their actual work. The variety becomes understandable also when we have a look at their learning styles in Figure 4.1. Our subjects are both theoretically and practically oriented.

4.1.2 Self-efficacy, Commitment, and Attitudes

Self-efficacy, commitment, and attitudes toward the computers are identified from the manner how the persons told about themselves related to computing and work in general. This is also done in order to understand the end users as application developers, especially their motivation. These categories are related to how the person relates him or herself within the work he or she is doing.

The personal position against computers refers to how he or she perceives him or herself, computers and computer related tasks. The most apparent categories derived from the data concerning personal features are presented in the Table 4.1.

Table 4.1 *Computer Self-Efficacy, Commitment and Attitudes*

Category/ Properties	Personal features Dimensional range
Computer self-efficacy	high - intermittent - low
Commitment	high - intermittent - low
Attitudes	positive - neutral - negative

The concept of *computer self-efficacy* (CSE) refers to how confident the person feels with the computer. A definition for c*omputer self-efficacy* in this study is referred from Marakas et al. (1998) as to *"an individual's perception of efficacy in performing specific computer-related tasks within the domain of general computing"*. In this study the interviewers' opinion of computer self-efficacy was not asked explicitly, but it can be derived from the answers to other questions.
The dimensional range for computer self-efficacy is defined as follows:

Low The person does not express very many perceptions about his or her ability to manage with computer related tasks.

Intermittent
The person speaks about his or her ability to manage with computers. He or she names and demonstrates applications he or she has developed.

High The person expresses very positive perceptions about his or her ability to manage with computers. He or she also demonstrates the applications he or she has developed and gives arguments about their usefulness to the organisation.

The concept *commitment* can be defined through the person's own behaviour or the efforts he or she is willing to do in his work. According to Abrahamsson (1999) (based on Humphrey 1989, Salancik 1982, and Brown 1996), commitment is defined *"as a level to which a person explicitly demonstrates his/her commitment by his/her behaviour or intended behaviour …"*. It is to some extent close to the concept of "specific computer performance" in Marakas' (1998) study. Porras and Hoffer (1996) define the level to what extent the person demonstrates the commitment into nine categories. The categories are C1: Communicating openly, C2: collaborating, C3: taking responsibility, C4: maintaining

a shared vision, C5: solving problems effectively, C6: respecting/supporting, C7: facilitating interactions, C8: inquiring and C9: experimenting.

Commitment always has a focus (Brown 1996). In the case of the EUAD, commitment refers to the person's willingness to use and sustain the use of computer in his or her work. In our study, the higher level of commitment includes behavioural features that take the EUAD activity in a deeper sense, seeing it as a part of organisational development, like C6-C9 in Porras' and Hoffer's category above. In this case, it refers to the willingness to share his or her responsibility outside his or her own job in the organisation.

The dimensional range for commitment is defined as follows:

Low The person communicates and collaborates openly. He or she is also ready to take responsibility and demonstrate it.

Intermittent
The person is ready to collaborate and taking responsibility. He has a problem-solving and goals-end orientation to his or her work. He or she is willing to take initiatives to develop his or her work and demonstrate it.

High The person has an inquiring and experimenting orientation to his or her work. He or she has a respecting and supporting behaviour towards others. He or she develops applications that help to solve problems also in the organisational level.

The concept of *attitudes* is quite many-sided. The most obvious approach is to note the person's positive and negative sides about computers. The intension of this concept bears the idea about a person's positive or negative attitude toward computing in general. We expect that this attitude can be seen in a person's expressions about the usefulness of computers in his or her work.

All three of these concepts, *Computer Self-efficacy, Commitment* and *Attitudes* are related to each other. It has been shown (Marakas 1998) that the specific computer performance i.e. commitment is dependent on computer self-efficacy. Additionally, Abrahamsson (1999) binds the concept of commitment and attitudes together. According to him the changes in attitudes are consequences of changes in behaviour. As he writes *"the individual becomes bound by his actions and through these actions to beliefs that sustain these actions"*. Actually, it is very difficult to make the difference between the attitudes that refer to computers in general, commitment or computer self-efficacy. The positive attitudes toward computers indicate strong commitment as well as computer self-efficacy.

Among our interviewees the utterances concerning his or her computer self-efficacy were quite high (see Table 4.2). It was quite characteristic because all persons also developed applications and they also told the researcher about it. Two of them (A and L) said that actually they do not like programming, but in spite of this, they expressed very positive perceptions about their efficacy related to programming.

"…it is easy in the sense that it is you who has to know what they want." (A)

Table 4.2 *Self-efficacy, Commitment and Attitudes*

Category/ Properties	Personal factors Dimensional range	
Computer self-efficacy	high intermittent low	ABCDEGHJKL
Commitment	high intermittent low	CDEGHJ ABKL
Attitudes	positive neutral negative	ABCDEGHJKL

Only one (J) said that he had suspicion about his ability to manage with the task. This case was special in the sense that the task was very challenging and it was his first application. Most of the utterances were in such a form that there was a problem and he or she just had to solve it.

"I had personally never done it before, I had only the perception that it was possible. How it happens, will become clear later."(G)

"You just double-click it and so it gradually starts going." (B)

When asked about difficulties and problems, no explanations were given as to why he or she did not manage to perform the task. The persons seemed to have quite a realistic view about their computer self-efficacy in more challenging tasks related to IT-professional work. One person (J) tried to professionally carry out the analysis but could not do it.

One person mentioned that he had problems, which he could not solve straightaway.

"I just did not understand it in my head." (B)

However, he managed to solve the problem.

"It just took a week or two… I still feel I beat those computers."(B)

The *commitment* focussed on using computers was measured by viewing the level of the EUAD activity. The general commitment toward the company was measured analysing how the person describes his or her contribution to the company as a whole. The more the person describes his or her applications by terms of organisational usefulness the more committed he or she is. The highly committed people also make initiatives and visions of organisational computing. Six of the persons demonstrated their commitment in terms of organisational development (C, D, E, G, H, and J). They also showed a high level of inquiring and experimenting stance to their own job as well as problem solving orientation in the organisational level. The initiatives varied from new application ideas to visions how the IT function and the EUAD should be organised as a whole. Most of the ideas were more or less connected to their own work. Most of new application ideas were applications that they thought they could develop.

All of the others showed at least an intermittent level of commitment. They all described their systems in terms of usefulness in their own work. They usually compared the usefulness of the earlier application the new EUA. No one showed a low level of commitment. This is quite apparent because of the selection criteria of the informants.

The *attitudes* toward the computers were mostly positive. That is quite obvious because of the nature of the special group of end users. The attitudes come out throughout the interview in the opinions about organisational goals, management, other staff members, etc. Even though the attitudes towards the managers and fellow workers where not asked directly the positive opinions were expressed on their own initiative.

The attitude toward the organisation was mostly positive. Only one person (J) complained the management in his workplace. The boss was mostly considered positive and being supportive. In one opinion (H) the boss was mentioned to be even "hyper intelligent". Also the person's perception about other staff members' attitudes toward the EUAD activity, express the person's own attitudes too. When asked about what the other people thought about his or her EUAD activity, the answers were mostly that the other people did not argue against it (A, B, C, D, E, G, H and L).

4.1.3 Future Career Plans

The future career plans reveal the EUADers perception about his or herself as an EUADer. The willingness to stay on his or her workplace without having any intention to apply an IT profession indicates an identity more as a non-programming end-user or a command level end-user than as a potential IT professional (see Section 2.1).

In the first interview, two of them (A and D) were actually promoted, but no other person had any plans to try a career as an IT-professional. They considered themselves more likely as a link between 'computer people' and 'ordinary users'. Even those persons (C, G, H, J and K) who had developed very challenging applications did not express any willingness to be an IT-professional. Also the promoted persons did not express anything that would indicate willingness to switch to another company. The persons enjoyed their actual job. This also was said to be the reason for staying at their current job.

"No, I don't think so (to become an IT-professional). My actual job… It is very challenging and interesting." (H)

Another reason given was that they did not consider themselves to have the required competence.

"I could become an IT-professional, but I doubt it, if I could be so good as my ego requires." (B)

"If it (programming) were the principal task, then the programmer should be pedantic and also quick." (H)

They did not actually express a clear plan for their career, desires or job, which they really wanted to do.

"I want to do all kinds of things ... I would like to be an archivist worker specialised in computers." (C)

"Well, after all, as a matter of fact, I am not interested in programming, basically. I do not know what I'm going to do in the future." (J)

They regarded the EUAD to be rather like some kind of hobby or interesting option in their work than a way to progress. Their identity as innovation maker or change agent was quite strong. When asked about their perceptions about the future, many of the persons (C, G, H and J) talked more likely about the future of their own work contents

and how it would be changed. Their role as the end-user was recognised clearly.

> *"Anyway as I see it, my own initiative development work, the point is how I do my part of the task in the best possible way."(K)*

4.1.4 Learning Styles

The EUAD is characteristically a matter of learning. In order to understand the phenomenon of EUAD, we have to view it also as a process of learning. How persons learn is based on their individual styles of learning (see Section 2.1).

We measured the learning styles of the persons using the Learning Style Inventory by Virolainen and Kerola (Virolainen & Kerola 1990 based on the original tests by Kolb 1984,1985). Kolb's Experiential Learning Theory categorises people into four groups according to their individual style of learning:

1) the converger style of learning
2) the accomodator style of learning
3) the diverger style of learning and
4) the assimilator style of learning

Figure 4.1 below shows that there is no dominating learning style. This indicates that the persons in our data can learn using all four learning styles. The converger style and accomodator styles are the most apparent. The individual differences are quite small. The results indicate that the EUADs very likely do things in practice and their behaviour is based on certain rules and logic. This is natural when we think of the nature of application development in the sense of constructing products using a programming language or other office tool.

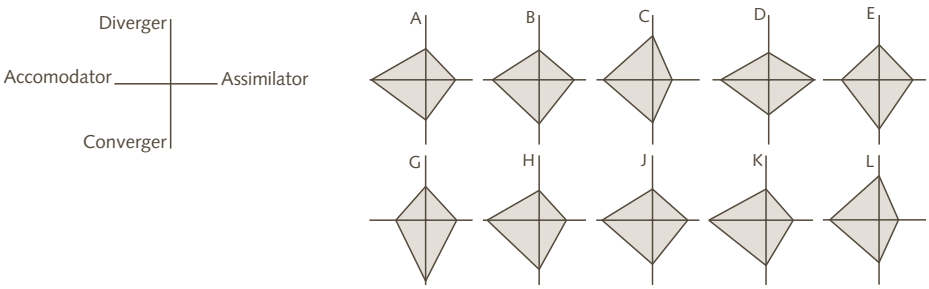

Figure 4.1 *Learning Styles of End User Application Developers*

The interviewees were not very good at getting a holistic view of the system under development. This is shown in the figure where the assimilator style of learning is at quite a low level. This was also expressed for instance in the interviews when the person said that he was not able to do any documentation beforehand even if he tried (J). The difficulty of getting a holistic view came out in person A's interview:

> *"… the most difficult is… when there are so many relations in those things… to manage these … how can you get them to work together in the program." (A)*

The difficulties above can be a consequence of the limited view of systems analysis. They are experts in other areas than computing. They have learned the systems thinking and programming mainly by themselves based on practical and specific context of their own specialisation area. They develop systems for themselves where they are not learned to negotiate about the solution.

The desire of accomodator and convergent style of people to do things came out very clearly in the interviewees, too. All the informants stressed their willingness to do and test their ideas in practice. The person with the highest score of assimilator (D) also had the highest education in computing. His activity as application developer started after getting a formal education in computing. He could be confident about his competence of doing creative applications. He also had high scores as accomodator, too. These scores refer to a person who first wants to get a total view about the system and then implement it.

To draw a conclusion about the personal factors of the persons we can presume that all the persons are quite active and have initiative both in the working life and in private life as well. They had early experience from computers and had learned programming. We also have to admit that we did not find anyone to be exceptionally active or geniotic person in the data. Almost everybody had common problems with the computers too. The attitudes towards computer related issues and commitment toward their employer was quite high. The negative comments were few. When investigating the EUADers as learners, the accomodator and convergent style of learning dominate. That indicates the "learning by doing" style with tendency towards following rational rules and theories.

4.2 Actual Work Contents

In the first research question we set the question Q1.2 (see below) to find out background information for the reason to start the EUAD activity. This question also serves as basic

information for research question 2 in which we have to find out the efforts and individual strategies the persons used in their EUAD activity. This question requires the information that describes the context in that the persons work. The question is:

Q 1.2 What is your actual work?

We started to investigate the EUAD process by asking the informants about their actual work contents (Q 1.2). It is an easy way to start to approach both the context and route to EUAD. All informants liked to talk about their actual work. The work itself seems to be an important factor of the EUAD. When asked to tell about him or her self, almost all the informants started to tell about their actual work contents. All of them started by giving a short description about the work title and daily routines and responsibilities.

The adjectives associated with work were mostly positive. The most apparent properties, which came out, were workload, amount of paperwork, variety, level of independence, and level of mental effort needed. The EUAD activity itself was also often expressed in the context of his or her job.

The informants were actually not very eager to describe their actual work contents. The talk changed from the work to the EUAD activity quite shortly. They gave more detailed descriptions mainly for the routines of their applications areas. Some features of the work were missing. These include among other things: how the work was composed of different tasks, what is the amount of working hours needed for each task, which of the tasks are most important, in which order the tasks are carried out, etc. The EUAD activity dominated the talk of the informant. The work content came out mostly in the context of computers.

The most apparent properties associated with work contents were the area of work, workload and the amount of paperwork (see Table 4.3). These concepts appeared at the most in the talks of the interviewees. All the persons were working in either support or control of production or financial functions of the firm (see Kerola & Järvinen 1975). Five of the persons (A, B, D, E, H and J) worked mainly to control and support the production function. One of them (K) supported the financial function and three worked on producing reports to support the production function of the firm (C, G and L). The lines between the production, financial and information functions are not very clear because the products of the firms for which persons worked are information services (C) or education (G and L).

The area of the work in this study refers to the vocational skills needed. We can make a course classification by dividing them into technical and administrative. The technical work content covers all work related to machines and control the function of them. For instance:

"… it is mostly operating and watching screens, controlling the network of the gas main." (A)

The workload means the informants expressions about his or her amount of work to be done. The amount of paperwork indicates the person's expressions about work like reporting, accounting and all kinds of tasks producing documents.

"… previously we prepared documents a lot." (B)

The variety means the number of different tasks of his or her work contents. The people having a work of high variety describe their work with several verbs. For instance, person C mentioned several different tasks in his interview including on-call, programming, acquiring software, computer assistance, photo archive maintenance, research etc.

"… yes I would like to do any kind of job." (C)

In this study the dimensional range for workload, amount of paperwork and variety of the work is defined by how the informant describes the property value as follows:

Property value:

Low The person expresses the property value using terms like "low", "little", etc.

Intermittent
The person expresses the property value using terms like "moderate", "fair", etc. or he or she do not give any evaluation about it.

High The person expresses the property value using terms like "very much", "a lot", etc.

A more deductive property is the degree of freedom in the work. If there is no freedom, the user cannot do anything based on his or her initiative. Under these circumstances, no EUAD occurs. The independence is divided into two sub-properties: firstly, the independence concerning one's own decisions in his or her work and secondly, the independence concerning the need of information from the organisational information systems. This means both the input and output of the applications developed. If all the data are gathered from the organisational systems and the output is defined beforehand, then the independence is low. The same person can be totally independent concerning his or her decisions at work but he or she can be totally dependent on the organisational computing. For instance, person H says that:

> *"Nobody comes to me and says that now I need this or that report, it is totally in my hands." (H)*

His company databases are centralised in one database:

> *"We acquired this Oracle's Process Control System, that covers all functions from sales to invoicing … I have used Access to prepare reports from it." (H)*

The work contents can also be classified on how demanding it is. Generally, all tasks required professional education. The informants did not characterise their work in terms of intellectual requirements even if the contents differ in this sense. The tasks can be classified according to the requirements of work contents by the level of how much each work includes tasks that require continuous mental effort. We apply here the task categories according to Järvinen (1999): *1) problem solving tasks, 2) applying tasks, and 3) routine tasks*. The task is *a problem solving* if the person firstly has to make a plan how the task has to be performed. Performing the applying task means that the person applies the plan derived earlier. In the routine task, applying is almost automated, i.e. the task is performed without conscious mental control.

Table 4.3 *Concepts Relating to Interviewee's Work Contents*

Category/ Properties	**Actual work contents Dimensional range**
Area	technical - administrative
Work load	low - intermittent - high
Amount of paper work	low - intermittent - high
Variety	low - intermittent - high
Level of independence of making decisions	low - totally independent
Level of independence of organisational information systems	low - totally independent
Level of mental effort needed	problem solving - applying - routine

Six of the informants work in an industrial environment, two in the public service sector and two in research or education. Five of the persons work in a technical environment. Their work is mainly supervising and reporting. The rest of them are working in an administrative or research environment.

The workload of all the informants is at least at 'intermittent' level. Six of the informants had quite a high workload (C, D, E, H, J and L). The most time consuming factor was the learning of tools. The programming also took a lot of time. The informants had their regular duties to do and the "extra" activities they had to do primarily in their free time. The informants normally did the programming during their working hours but the learning and problem solving happened outside office hours.

"Yes, the studies took place attached to work…I studied weekends and still worked full time." (D)

"I have taken care of my job at the same time …it was quite exhausting…" (J)

The amount of paperwork was also quite high. In this study the paperwork covers all kinds of administrative tasks producing documents even if it is performed using a computer. The high property values in this were mostly among the persons doing administrative tasks (C, G, H, J, K and L).

The variety of the job indicates the number of different tasks the work includes. In this study the word 'task' refers to limited and compact assignment that one person or a group of persons can complete. A job consists of tasks and a task can be switched from one job to another. Some of the jobs cover more than five different tasks to do. The more tasks the job includes the higher the variety is. In this study more than five different tasks indicate high variety and two or less tasks a low degree of variety. The variety of the job among the persons is quite high. We could pick up several different tasks from intermediate to high level.

The certain property values indicated by the informants are listed in Table 4.3. A summary of the characteristics of the interviewee's work is shown in Table 4.4 on the following page.

Table 4.4 shows that six of the persons' work consists mainly of technological/technical affairs (A, B, D, E, H and J). Four persons work content is basically administrative. The persons have more workload than usually may be expected. Six persons (C, D, E, H, J and L) have it more than the average. Six persons (C, G, H, J, K and L) have to do paperwork a lot. This group covers all the administrative persons in addition to two persons with technical work contents (H and J). The findings about the job variety show that those persons having an administrative task have higher values

Table 4.4 *Property Values of Interviewee's Work Contents*

Category/ Properties	Actual work contents of each informant Property values of informants	Persons having the property value
Area	technical	ABDEHJ
	administrative	CGKL
Work load	low	–
	intermittent	ABGK
	high	CDEHJL
Amount of paper work	low	–
	intermittent	ABDE
	high	CGHJKL
Variety	low	ABDJ
	intermittent	EKL
	high	CGH
Level of independence of making decisions	low	–
	intermittent	ABEHK
	totally independent	CDGJL
Level of independence of organisational information systems	low	–
	intermittent	ABDEHJ
	totally independent	CGKL
Level of mental effort needed	problem solving	CDGKL
	applying	ABCDEGHJKL
	routine	ABCDEGHJKL

than the persons having technical tasks. The minimum value for the administrative persons is "intermittent", but there are only two technical persons having that a low value.

All persons are quite independent to make their own decisions concerning their work. On the other hand, the persons can also be dependent of the organisational information systems. The level of independence in the work is determined by the expressed own decisions made at work. All persons showed at least an intermediate level of independence. Five persons (C, D, G, J and L) can be regarded as totally independent relation to their decision making. Almost all, especially the persons working in a technical environment were dependent to some extent on the organisational computing. This fact appears, among other things, from their realistic opinions about the role of the EUAD.

> *"I hope that the things could go so – I mean in the future – that this basic mass could be processed with the software packages. The huge amount of data could exist as centralised and then we could do it in such a way that some parts of the data could be taken into an extension process to prepare some reports…" (G)*

We evaluated 'The level of mental effort needed' based on the descriptions of tasks by the informants. In most cases (C, D, G, K and L) the work includes tasks, which required problem solving, such as planning and analysing. Most of these jobs required a formal academic degree (C, G, K and L) as well. The job in all cases included tasks requiring the ability to *apply* a certain plan or a rule in the task. All informants also told about *routine* tasks, which they have to do.

4.3 Description of the EUAD Process

In the second research question we set the goal to find out what are the efforts and individual strategies of the EUADers in the EUAD activity. Consequently, we wanted to relate these efforts to what kind of applications they have developed, what tools used, and how much time the EUAD activity takes. We also want to know on what motivational bases the persons work. Although this is not asked explicitly, the answers will probably come out in the answers to other questions throughout the interview. The questions aiming to the second research question are:

Q 2.1 Tell me about your application development activity: What kind of applications you have made? What tools you use? How much time does it take time?

Q 2.2 What kind of problems have you recognised with application development? How do you solve them? How do you gather information. Do you have any friends to ask help from?

Q 2.3 Do you use any IS development method? Do you document your systems?

In this section we analyse the data of the first interview when the informants described their own process of adopting new tools in their work. We analyse the types of applications, used tools and methods in subsection 4.3.1. After that, we analyse the development intensity and motivation structure in subsection 4.3.2. In 4.3.3 we draw a model of how the EUADers adopt new technology as two patterns of adoption. In the next subsection 4.3.4 we link the tools used and patterns of adoption and finally in 4.3.5 we categorise the EUADers into four groups based on their motivation and the context where they developed their applications.

4.3.1 Applications, Tools and Methods

In this section we analyse the EUAD process as how it is expressed through applications developed (Q 2.1), tools and working methods (Q 2.2, Q 2.3) used. Also the problems are analysed and how the EUADers try to solve them especially by acquiring information and help.

4.3.1.1 Types of Applications

We asked about the application types made in question Q 2.1. This question was also the easiest way to start talking about the EUAD. In this study the applications developed are not interpreted as final goals of the EUADers but rather as a way to reach some other goals in their jobs.

The informants spoke about their applications mostly by naming the applications implemented. All the applications can be categorised as tools that were made to help the EUADer to automate routines of tasks. Some of the applications (B and K) were developed for their own use and some (C,D,G and J) for others. Some applications were developed both for their own use and for the use by others (A, H, E and L).

All the applications were developed to perform routines in their work. Most of them developed applications, which perform calculations (A, D, E, G, K and L) and some developed applications that collect data into a database (B, C, H and J). One of them (H) developed applications of both type. A summary of application types and scopes are listed in Table 4.5.

Table 4.5 *Types and Scopes of the Applications*

Category/ Properties	**Scope of application** Own use	Others	Both
Calculations	K	D, G	A,E,L
Data bases	B	C, J	
Both			H

4.3.1.2 Tools and Methods

The most widely used concepts referring to tools and methods in the data concerning the EUAD are listed in Table 4.6 below. The tools used were the topic that the informants

quite likely spoke about. The other categories, working methods and method of information acquisition, were asked explicitly. The informants also expressed problems, which they had in the process of analysis and implementation.

Table 4.6. *The Properties of End User Application Development*

Category/ Properties	**Tools and Methods** Dimensional range
Tools	spreadsheets - data base - programming languages
Working methods	no systematic methods - methods used
Method of information acquisition	trial and error, courses, friends/colleagues, manuals, Internet (WWW, discussion groups), help systems, magazines/journals
Problems	isolation, no courage to ask help, organisational disharmony, difficulties in analysis, difficulties in implementation

The property instances for the categories in Table 4.6 are listed in Table 4.7. All the informants mentioned the tools they had used. We divided the tools used into tree categories: Spreadsheets, databases, and programming languages. No other office tools than spreadsheets and databases were mentioned nor did anybody use any 4GL-application development package. The most widely used tool was the spreadsheet (A, B, E, G, K and L). Some of those people using spreadsheets also used databases. The programming languages were also used quite widely; four informants (C, D, H and J) named one or more applications, which they had programmed by using a special programming language.

A systematic method for application development or information acquisition did not exist. No document preparation or systematic analyses of requirements were found. Only one informant (J) said that he had tried to analyse the problem but did not manage to do so.

> *"In the beginning I intended to prepare a clear description of what would happen in the store, and what the program should do. But I was not able to do it." (J)*

The most popular method of information acquisition was "trial and error" (A and B) and the help-systems of the program packages (D, E, H, J, K and L). The help systems were usually mentioned to be the best way to solve the problem. Nobody mentioned that they

were not used, or the problem would not be solved with it. Seven persons (B,C, D, F, H, J and K) mentioned to have used manuals and textbooks. Many informants said they had attended short courses (A, D, E and G). These people were also the educated ones and had developed applications at the most. These users also had other channels like friends or colleagues (C, D and K), journals (J), Internet (A, E, J and L) and even discussion groups (J). Even if all the persons had trained the skill by themselves, nobody was totally self-educated. All of the informants had got formal training in some form either at school or at a short course.

The methods are linked to the problems in the EUAD. The most apparent problem by the informants was the isolation. Almost all of them were the only people in their own working place who performed this kind of tasks. Only one (G) found help from his working place. Many of the informants even showed no willingness or courage to ask help from others. Any way, they could not use their local contacts, because they themselves had the best knowledge. Some of them had contacts with their course fellows or other friends. When asked if they had friends or colleagues, from whom they could get help, they (A, B, C, E, H and L) usually answered doubtfully as follows:

"No, it is me whom they turn to." (H)

"Well, yes and no, most of the fellows know less." (L)

Even if there were IT -specialists in some working places, the interviewees did not ask help of them. Especially in the workplaces of educational institutions (G and L), there were IT-professionals available, but the EUADers did not ask help of them. In one case, the IT-professional did not like the EUAD activity at all (J).

Any way, in spite of the problems with getting help and information from others, the informants had contacts with their fellow workers. The most contacts were made during the time when they implemented the new applications (A, C, D, G, H, J and L). Mostly they attended to the use and set up of the application (C, D, G, H and J). The role as a general adviser did not appear to be very clear. Three persons (A, C and L) expressed cases where they had helped others. The help given to others was mostly helping to solve problems in application development.

The informants also expressed problems related to the development work. Nobody had analysed their application problems properly, but only two expressed the problems caused in it (A and J). When the informants told about their skills in programming, some of them (A, B and E) were not very confident with it.

"It (programming) is quite difficult… or it is not…it is just difficult." (E)

The problems with the management (organisational disharmony) were expressed only in two interviews (C and J). The manager of person J did not like the EUAD activity because

it was performed without his permission. The problems of person C were concerned with his peers, but these problems were quite small.

Only one mentioned having had any technical problem (C). None of them said they had problems with, for example the software provider, functioning of the computer or software.

Table 4.7 *The Instances of Some Properties of End User Application Development*

Category/ Properties	Dimensional range	Persons having the property value
Tools	spreadsheets	ABEGKL
	data Base	AHL
	programming languages	CDHJ
Working methods	no systematic methods	ABCDEGHJKL
	methods used	–
Method of information acquisition	trial and error,	AB
	courses,	ADEG
	friends/colleagues/experts	CDEK
	manuals,	BCDFHJK
	Internet	AEJL
	help systems	DEHJKL
	magazines/journals	J
Problems	isolation	ABCDEHJKL
	no courage to ask help	ABJ
	organisational disharmony	CJ
	difficulties in analysis	AJ
	difficulties in implementation	ABE

4.3.2 Development Intensity and Motivation Structure

In this section we analyse the motivation structure and intensity of the EUADers. These properties are very important for our study, because they are in the focus of this thesis.

The development intensity is the level of how much the end-user uses his or her time for the application development activity. The intensity of the activity is inferred from expressions like 'lack of time' for application development or how many computer

courses they attended or how much they had used their own computer during their leisure time.

The categories of motivation are based on literature (Section 2.1). The motivation can be divided into *intrinsic* and *extrinsic* motivation (Davis 1992, Deci 1975). Additionally, the motivation can also be based on *subjective norm* (Ajzen and Fishbein 1980). The intrinsic motivation refers to the person's own interest in the activity itself. The activity is performed, because it is enjoyable and fun per se. The expressions about their positive attitudes towards computing can also be included in this category. When the extrinsic motivation dominates, the process of performing the activity is driven by the reinforcement of the value of the outcomes of the activity. The subjective norm is linked to the social pressure to be a good worker in the eyes of others.

Table 4.8 *Intensity and Motivation of the EUAD*

Category/ Properties	Dimensional range
Development intensity	low - intermediate/intermittent - high
Motivation structure	intrinsic - extrinsic - subjective norm

The most apparent and also measurable factor revealing motivation is how intensive the person works especially when no surveillance is present. In this study, the voluntary innovativeness and work at home, together with verbal expressions indicate the intensity of the EUAD.

The values for properties in Table 4.8 are listed in Table 4.9. The dimensional range is defined as follows:

Low development intensity

The person uses primarily his or her office hours for the EUAD activity when there is time for that. He or she is not willing to use off duty hours for the activity.

Intermediate/intermittent development intensity

The person speaks about his or her activity enthusiastically. In addition to the office hours he or she also uses his or her own free time to a certain extent, but he or she tries to restrict this extra workload at home.

High development intensity

The person uses, in addition to the office hours, also his or her own free time a lot. He or she attends IT related courses and studies new tools at

home. He or she quite often mentions terms related to extra workload, but is not willing to restrict it.

Among the persons interviewed, there did not exist anyone who did this activity only during office hours. All the informants had used their leisure time for the EUAD activity. The most general way of using one's leisure time for the EUAD activity was attendance in programming courses or reading manuals and books at home. The use of computer at home was quite popular: six persons (B, C, E, H, J and L) said they worked with their own computers at home. Five of them used their own PC for developing applications at home (C, E, H, I and J). It seemed to be a norm to study new things at home.

"Then I just took the DBaseIII manuals home and…" (C)

Many of the interviewees expressed the lack of time for the EUAD but did not complain about the high workload. They were quite aware that it was their own decision to start the EUAD activity. This is true especially when they are learning new tools. These persons explicitly exposed *intrinsic* interest in application development and problem solving itself. They used statements where they described their positive feelings like:

"Yeah, it (programming) is fun. Everybody has perversions of his own, of course." (B)

"This is my personal opinion, one should always have playfulness in the computing work." (E)

"The programming is really fun. It is somehow rewarding when you finally see that your application really works." (H)

Some informants (A, B, D, H and J) linked the motivation to the programming or problem solving itself.

"Well, it (the creative stage) is the most interesting, at that time you are at the best mental activity, when having a problem... when you get it solved and know that you can write a module for it...it is not interesting any more." (J)

The *extrinsic* motivation refers to the usefulness of the activity for the work. Eight of the persons linked their activity to the extrinsic motivations like usefulness in their work (C, F, K and L). Also the benefits for work performance are the EUAD itself. This motivation was revealed in the way that the informants more likely talked about their work than about programming itself.

"Well, I was interested in it (application development), of course. I would not have started to do that if I had had no interest. The starting-point was that I realise, that this job cannot be done in that way." (J)

In one interview (E), the motivation was linked to the general expansion of information technology. The interviewees thought that they just had to follow the trend in order not to be "out". The use of computers was expressed to be trendy or useful in a broad view. The reason for using computers was expressed in more general terms linked to the overall expansion of information technology.

> *"In a nutshell, I have two children of 9 and 11 years old and I think that the earlier you can get them to know the computer… the easier it is for them to master this world…"*
> *"… everything that is linked to electricity or computing is somehow sporty…" (E)*

This kind of motivation is not expressed directly by words. One can see how the informant expresses himself as an active and good worker, when adopting new technology. The managerial support can be categorised as a source of subjective norms, too. If the person gets support with a certain activity, he may think that he or she has the social responsibility to perform the task.

Some of the persons expressed both intrinsic and extrinsic motivations. Those who started by processing a huge amount of data with spreadsheets expressing the automation of routines as their primary reason (I and K), also said they were interested in it.

> *"To that extent, I am also interested in the fact that I have continuously tried to acquire knowledge." (G)*

In the same way, those people who did EUAD based on intrinsic motivation, also expressed that the application should be useful as well.

> *"There is no sense in developing that kind of application which serves nobody." (D)*

Table 4.9 *Property Values for Intensity and Motivation of the EUAD*

Category/ Properties	Dimensional range	Persons having the property value
Development intensity	low	–
	intermediate/intermittent	ABDEGJ
	high	CHL
Motivation structure	intrinsic	ABDHJ
	extrinsic	CEGKL
	subjective norm	E

4.3.3 Patterns of Adoption

The cases how the persons adopted new technology had all their individual features. They can be categorised into certain patterns. In this section we define two typical patterns adoption that we found from the data. The basis for these two patterns is based mainly on the motivation structure analysed earlier. The pattern of adoption can vary among adoption cases. The EUADer can use different pattern of adoption depending on the case.

Although the EUADers seemed to be motivated both by extrinsic and intrinsic motivations, it was possible to find two patterns of adoption for both of the motivations. One group, who seemed to be mostly intrinsically motivated, adopted what we have called a **desire-driven (DD) pattern** as follows:

i) there exists a desire to develop an application;
ii) a search is made for an appropriate problem to solve;
iii) implementation;
iv) bidding for adoption.

The motivation, which drives the behaviour in the pattern DD is basically intrinsic. About the application development the informant used words like "fascinate" (D), "for fun" (H), "interesting" (E and J). Persons following mostly DD pattern (D, E, H, and J) mentioned the desire to develop application or their skills as the principal reason for the EUAD. The context itself does not seem to be so important. They wanted to use their skills or to learn a new programming language or they just wanted to experiment with programming. A typical case is person H, who develops applications wherever he sees an opportunity for it.

"I have thought about what kind of systems I could do." (H)

By contrast, in the **requirements-driven (RD) pattern**, an extrinsic motivation is dominating:

i) there exists a situation in the work context which would benefit from automation;
ii) implementation;
iii) adoption.

Typical cases for application development of pattern RD (A, B, C, G, K and L) are the stories of persons K and G. They usually have a mass of data or a repetitive task to perform and the developer thinks that

"…this could be carried out more intelligently." (K)

These persons stress the point of utility of their applications. They mostly use office tools and have started from small applications and developed them step by step as they learn more. They all, except person G, developed the applications for their own use. The tools used are office tools, like a spreadsheet or database program. The extent of how widely the features of the tool were used varied among different developers in this group. Persons H, G and K used the macro language widely, whereas persons A, B and L used the macros mainly in specific situations. These persons were also younger and taking the first steps in their application development activity.

The pattern does not, however, seem to depend on the person. The same persons used both patterns depending on the use context. For example, person H used DD when he developed applications for others and RD patterns when he developed applications for the use of his own work. Persons A and B expressed intrinsic motivation to develop systems and they actively looked for new opportunities to develop applications in their own work. Person C is a special case. His activity started actually from organisational decision. He was given the task to acquire a computer and software for the archives where he was working. The development process went on in the way that the archives institute eventually decided to start to develop an application of their own. This decision was totally made on person C's own initiative. The process differs from the others in the sense that originally the application is designed for wider organisational use and not for an individual task.

The Desire-Driven (DD) EUADers were all graduates of Schools of Technology and the Requirements-Driven EUADers presented more University and business-oriented backgrounds.

4.3.4 Patterns of Adoption and Tools

In this section we link together the pattern of adoption and tools used. In other words, what tools do the EUADers having a specific pattern of adoption use?

The persons can be divided in two groups depending on how the EUAD activity is related to their actual work. The first group of the EUADers covers the persons who develop mostly applications for the use of his or her own work. The term *'Power Users'* describes them best (A, B, E, G, I and K). They have started to use an office tool such as spreadsheet or database program in their organisational task. Then, step by step, they have more utilised the advanced features of the software.

> *"Well, it was quite simple. It started so – was it Lotus at that time as a spreadsheet tool and using that we run the sheets a lot. They were quite large, big sheets, it just started with the automation of the routines." (K)*

> *"So, this Lotus 123 has the macro language, it facilitated things a little... when you repeatedly do the same things, it facilitates it ... when the guys in this supervisor room do, they are no computing people..."(A)*

The power users also use the programming or macrocode possibilities of the software. The macrocode constitutes part of the system, the core of the system is the spreadsheet or database data model. Their basic orientation towards the EUAD is that they apply their activity to their own work in order to enrich or facilitate it. The next excerpt describes the attitude about work-orientation:

> *"The first system, I prepared it as to the most advanced, I mean in regard to the users … they worked with the job the whole spring and got the selection of the students into a reasonable order. At that time we started with the idea that we got the lists of groups ready." (G)*

The other group of the EUADers covers the persons who develop applications for use of others (C, D, H and J). They are called as ''*End-User Programmers*'' in this study. Their basic attitude toward the EUAD activity is the application itself. One of them (H) develops applications for people in other organisations too. The EUADers of this group are interested in programming and application development itself. They used more professional terminology and told their activity as developers. They used language of application development rather than the language of their work. For example:

> *"We acquired this kind of Operation Control System from Oracle…" (H)*

They also expressed more intrinsic (D, H and J) motivation towards the application development activity. These users talked about their activity using more professional terms, like features of programming languages.

Table 4.10 *Pattern of Adoption and Tools Used*

	Pattern of adoption	
Tools used	**DD pattern**	**RD pattern**
Programming languages (End-user programmers)	DHJ	C
Office tools inc. macros (Power users)	E	ABGKL

We summarised the pattern of adoption, tools used and basic motivation and orientation in Table 4.10 (page 95). There we can see that the tool used is linked to the orientation. The users who have started to use office tools in their work also have concentrated on the development of how their own work could be done better. None of the persons has later started to develop applications for others with programming languages. Also, the persons in the group of 'End-User-programmers' have originally started the EUAD activity by programming languages.

4.3.5 The Role of EUAD for the Worker

This section summarises the EUADers into four categories. The classification is based on the analysis of the EUADers on working context with different motivations and goals. The basic idea for each category is what role the EUAD activity has in relation to the EUADers working career. We describe each category and try to find the most typical characteristics of them.

The persons differ from each other in what role the EUAD activity plays in their own expression about their work, other workers and themselves. Although the differences are obvious, it is the most difficult for the researcher to interpret. We found several features from many cases. We tried to find the most dominating attitude about how the person takes the activity. For some of the informants the EUAD activity seems to be more and in a different way important than for the others. We found four different types of the EUADers depending on what role the EUAD activity plays in the EUADers work. The categories are not mutually exclusive.

1) The inventors (A, D and H)
2) The utilitarian users (G and K)
3) The work enrichers (B and E)
4) The opportunity seekers (C, J and L)

The first type of the EUADers includes the persons who like to "invent" new applications all the time. Those *"inventors"* usually follow the DD pattern of motivation and like to develop applications for others too. For them, the work is more like a hobby and their work usually includes computing to the extent that is quite natural to develop own applications, too. These features can be found among persons A, D and H. These persons had also developed the most applications. They took their EUAD activity as a part of their work. They were also asked to develop applications for others, for example,

> *" … when they acknowledged my skills, they asked me to develop some applications…". (D)*

Both of the persons (D and H) are independent to make their own decisions. That also means independence to choose if they want to develop applications or not. Anyway, their work is becoming more and more a job where the application development is part of it.

"My job is actually to be a supervisor…"
"I am responsible for the databases of the whole firm." (H)

The second type of the EUADers, the *utilitarian users*, contains the persons who want to facilitate their work by automation of routines. This motivation was mentioned at the most. Every informant mentioned how his or her work has become easier and more efficient because of the EUAD activity. This is quite natural because this motivation is also socially accepted and it is the reason why computers are supposed to exist. Anyway there were persons, for whom it was the only reason and who did not even mention other reasons. For them the advantage of using computers and developing applications was obvious. These users were both accounting persons who used the computer for processing a huge amount of data (G and K). For them there was nothing special in the EUAD. They told about computers like any other tool.

"The real reason is to maximise laziness." (G)

The third type of the EUADers, the work *enrichers*, includes those people whose primary motivation is to enrich their work by applying new software technology (B and E). Their primary motivation is to make the work more interesting and try all new tools. They also have some 'playfulness' at their work. They see it as somehow 'trendy' to use modern information technology.

" … during that phase an idea came to me, now as the gentry send fine faxes so I considered creating refined documentation. Just in the same way…" (B)

Finally, the fourth type of the EUADers, the *opportunity seekers*, includes those people for whom the EUAD activity was in some way significantly special. In some cases, their activity has raised their position in the working community (C), whereas some others are still beginning to use the opportunity to demonstrate their skills. In some cases it also caused instability in the organisational power structure (J).

These people are also different in the style of how they express their opinions. Some of them use expressions, which emphasise their own computer skills in relation to the others.

"… we have to go for this work, because it is obvious that <u>we are the best</u> in this field…" (C)
"…an engineer wants to build a machine ignoring the fact that the same work

could be done manually much faster, but what I did…"
"… firstly, I know that I have the knowledge to … (L)

They often express strong opinions about computer related topics:

"… I started to look for people (IT professionals) …Those, who I knew, working in big software houses, said that they knew nothing about micro computers … nobody had the competence! …but, I emphasised to my boss, that we can do whatever we want, but we have to consider what we do." (C)

Two persons (C and L) had special status in relation to their co-workers: Person C is the only staff member having a non-humanistic degree. The other co-workers are researchers in history. Person L also worked for an academic institution with other researchers. He was young and not yet completed his master's degree. He had to show his contribution to the research community. They also differentiated from the other informants in the sense that they both worked in an academic environment where the EUAD activity was highly respected. The computer skills were the thing that made the difference between the EUADer and the others. The case of person J was quite similar. He had just recently started his job as a warehouse manager. His work was not challenging and he knew that he could do more. The out-dated stock-control system gave him an opportunity to show what he could do. To summarise, we can say that the EUAD activity worked as a tool to make space in the working community.

4.4 Consequences of EUAD

In the third research question we set the goal to find out what consequences the EUAD activity has to the person itself and the organisation. In this research we are especially interested to what extent the EUAD activity has changed their actual work content. Consequently, we wanted to know, in addition to new tasks in work, how the communication between the EUADer and the rest of organisation has enlarged and changed. We analyse the changes in two periods of times. In Subsection 4.4.1 we analyse the short-term changes in their original working place that came out in the first interview. In Subsection 4.4.2 we analysed the data of the follow-up interview. This analysis shows the long-term effects on the work career due to the EUAD activity. We describe their work careers and try to find an explanation for the person's individual choices since the first interview.

4.4.1 The Short Term Changes on Work Content

One of the apparent changes in work content after starting the EUAD activity was the ease of paperwork. All informants expressed that fact in some way. This was especially true among those persons producing reports (A, B, C, H and K). The amount of reporting has also increased due to the new applications. Many of them regarded a paperless file system as an ideal state.

"I personally never ever want to save a paper note in those files." (B)

The course of work has been to assimilate more and more computer-related tasks. In many cases, when the EUAD activity was noticed, the persons had given more duties in that area.

The effect on work content varies among the persons depending on the application area of the systems developed. Those persons who developed applications for their own use (A, B, E, H, K and L) could also improve and enrich their actual work. Moreover, those persons who developed applications for others had to maintain two different duties. Many of them had to reduce the earlier work or delegate duties to others. For instance, person C dropped his duties on photo archives and person D divided the weekdays between application development and his original work.

4.4.2 The Long Term Effects on Work Career

The long-term effects of the EUAD appeared considerable in many senses. Six of them have changed their job. The work content of the others has also changed a lot. In this subsection we try to find an explanation of how the EUAD is linked to the willingness to change the job.

4.4.2.1 The Work Careers of the EUADers

Table 4.11 on the following page shows the final professions of the persons during the second interview. The table shows that quite many, six altogether (C, D, E, H and J), have changed their job to IT-professional. Three persons (D, H and J) have started a new job that consists mainly of programming. With one of the informants' (C), the work content has changed to the extent that it actually consisted, during the times of the second interview, mainly of IT tasks. Two persons (A and E) work in an IT department as a technical assistant supporting end-users and maintaining computer systems.

Table 4.11 *Transitions from one Occupation to another Occupation*

Person	Original profession	Final profession IT/development	IT/support	End-user
A	operator & controller		x	
B	technician			x
C	researcher (and IT/ Development)	x		
D	technician	x		
E	electrician		x	
G	lecturer			x
H	laboratory supervisor	x		
J	manager of logistics	x		
K	project leader			x
L	student			x

Persons A and D were about to change their jobs already during the first interview because they were promoted. The case with persons H and J was different; their employer wanted to keep them in their original jobs but still allow them to create applications too. This did not actually work in the sense that they changed their jobs later anyway. The work content of person H changed to the extent that it was actually an IT job by nature.

> *"Concerning these IT tasks, they went on until the end of my employment. The work consisted more and more of that kind of task that I wonder if we can name it 'end-user application development' anymore." (H)*

Person J worked for his previous employer for a few months after he implemented the stock-control system. Even though he was allowed to develop the application he did not regard his job as challenging enough.

> *"My work would have remained the same in a way. I had to take care of the storage but nothing more challenging. If I wanted to do something more difficult, I should have had to find a software to create or another problem to solve by myself. But that kind of problem did not exist." (J)*

All except one (C) of the persons who had changed their profession worked in industry in a technical job. Their work consisted mainly of maintaining technical equipment. Moreover, the people working in administration (G, K and L) stayed as end-users. As a matter of fact these people had diminished the EUAD activity. The need to create new applications was no more so apparent than it was earlier. The reason was the introduction of more advanced systems in administration.

> *"The school administration system at those times caused you to develop some add-on applications in order to get more the system than it could in normal circumstances do. Now after that, the system in our unit has changed. This new system is more advanced to the extent that for the time being, there has been no urgent need to rummage through the database of that system." (G)*

Moreover, the work content is different in the sense that it does not offer the need or opportunity to create your own applications. For instance, in the case of person L the new job as business systems representative needed a totally new view to information systems.

> *" Now I have to see the things more long-run and not just what you can do by Excel. We can now think about what we can do for a particular business area. This is a bit wider scope." (L)*

4.4.2.2 Reasons for Seeking IT Job

According to the first interview most of the informants who changed their job to an IT-profession did not originally strive toward it. When asking future plans and the persons willingness to apply for an IT job (Q 1.5 What do you think about the future? Do you want to apply a job as an IT professional?), they did not actually express any clear plan or desire for the future. Their original goal was more likely to combine IT skills and that knowledge in the application area under development.

> *"No, I don't think so (to become an IT professional). My present job covers many other things too. It is challenging and interesting." (H)*

The work was changed, as already mentioned, toward containing more and more IT tasks. When asking the reason to change the job (FUQ 1.1: If you have changed your job, what is the main reason for it?) he stressed mainly personal reasons for establishing his own business.

> *"Well, one thing is the craziness of my family. All family members of mine are entrepreneurs." (H)*

The cases of other persons were different. When analysing the interviews of person J we can draw the conclusion that he originally wanted to become an IT professional.

> *"If the employer would have found some IT job, that kind of talk we had, … I maybe would have stayed to do that work." (J)*

The persons who became to the field of IT support (A and E) also expressed the original desire to become an IT professional. Person A mentioned her IT education. Person E said that he always had been the one who does things. The work itself had the tendency to go toward the IT profession.

> *"I don't know, it came like partly incidentally, that we were driven totally into that profession." (E)*

The tools that the EUADers used at the point when they started the EUAD activity indicate the basic intention toward systems development. Table 4.12 shows that those persons who finally become IT professionals used programming languages already from the start whereas they who used office tools stayed (excluding E) in their original jobs. This indicates that those people who used programming packages already from the beginning wanted, intentionally or unintentionally, to became an IT professional in the future. The usage of a real programming package enabled them to develop professional software already at the start of the EUAD activity whereas the office tools would have solved only a limited problem at hand.

Table 4.12 *Tools Used and Final Profession of the EUADers*

	The final profession		
Tools used	**IT/development**	**IT/support**	**End-user**
Programming languages	CDJ		
Office tool		E	BGKL
Both of above	H	A	

The original motivation type and pattern of motivation relate to the final profession. Table 4.13 shows the original motivation expressed in the first interview and the final profession of the person's at the second interview.

On the other hand the extrinsic motivation and RD pattern of motivation seems to indicate the willingness to stay in the original job. As shown earlier, these people are more interested in developing their original job than just creating applications. On the other hand, the intrinsic motivation and desire driven pattern of motivation actually indicates a real willingness to seek an IT profession despite the fact that this tendency was

not expressed in the first interview. Person H had already during the first interview the same desire (as his family had) as he expressed in the second interview to start a business of his own. In this case the enterprising and intrinsic motivation toward IT made him leave his job. The case of person J was similar in the sense that he also left his job because of his intrinsic motivation toward IT jobs.

Table 4.13 *Original Motivation Expressed and the Final Profession of the Persons during the Second Interview*

	The final profession		
Motivation and pattern of motivation	**IT/development**	**IT/support**	**End-user**
Extrinsic, RD	C		GKL
Extrinsic, DD			
Intrinsic, RD		A	B
Intrinsic, DD	DHJ		
Subj. norm, RD			
Subj. norm, DD		E	

We can also look at the professional careers in light of what role the EUAD activity plays in the work for the person. Table 4.14 shows how the persons of different types of the EUADers are willing to move on to become IT professionals.

Table 4.14 *Original Type of EUADer and the Final Profession of the Persons during the Second Interview*

	The final profession		
Role of EUAD for the Person	**IT/development**	**IT/support**	**User**
Inventor	DH	A	
Opportunity seeker	CJ		L
Utilitarian user			GK
Work enricher		E	B

The table shows that the Inventors and most of Opportunity Seekers have changed their profession. Persons A, C and D stayed in the company whereas persons H and J left the company because their personal desires did not meet the work contents of their original job.

4.4.2.3 Power Plays of the EUADers

The EUAD activity by some of the EUADers also enacted discussion and led toward conflicts, too. This was true especially among the Inventors and Opportunity seekers, who were the most innovative and were also actively developing applications using programming packages. Persons C, D, H and J belong to this group.

The contradictions caused by the EUAD were dealt with different ways among the companies. In some of the cases the skills of the EUADers could not be taken into account. Some companies took the situation positively by giving them more and more IT related tasks, but some others did not like that kind of situation where people do tasks without the official permission. In the case of person D, the company gave him programming tasks right away after his skills were noticed. Later on he was also promoted. The cases of persons H and J were different. In both cases the EUAD activity caused conflict with the IT department. For instance, the work of person H was more and more changing toward the direction that he was no more sure if *"you can talk about end-user application development anymore"* (H). He got along very well with the boss of his own department, but the IT department did not like his EUAD activity.

> *"Of course there were rules and opinions depending on the person. Let's say that my supervisors saw it very positively ... but then, well ... the IT manager has his own problems to attend to. His way of doing things and procedures follow the general company policy ... so, well ... we also had heated discussions sometimes." (H)*

The case with person J was different in the way that he was not happy with his actual work content and salary. Even if his skills were noticed, he did not get new challenging IT related tasks nor more money, he left the company.

> *"And then... as the salary was 8200 FIM, not very high even for the persons doing the basic job. When I demanded higher pay, they even argued about it... So I decided not to ask for higher pay and nor plans for the future in that company. I totally left that company to work for other companies." (J)*

The case with person C was different in the way that he did not change job. At the start when he began to develop applications he also had some heated discussions but more

with his fellow-workers and not with his boss. His strong personality helped him to manage. He is still respected as a worker and system developer.

To summarise the findings of this subsection we can state that the EUAD activity has both immediate and long-term effects. The immediate effect of the EUAD can be seen both in the work contents and status. The EUADers start to apply IT to new areas and they also get more and more IT related tasks. The paperwork diminishes less and the work concentrates more on the usage of computer. In the long-term, the EUAD activity affects the future career of the person. The motivation structure, which is very personal in nature, drives the selection of tools and working methods and finally the main course of the professional career. The intrinsically motivated EUADers are interested in IT technology per se. They use the DD pattern of adoption driving them also to search freely for new areas for their applications and choose professional tools and working methods. The Inventors and Opportunity seekers represent this group of people. The way in which their innovativeness is used depends on the organisational situation and IT policy. In some cases organisation can take the EUADers skills into use but it can also happen that the EUADer have to leave the company to seek a new job as an IT professional. Moreover, the extrinsically motivated EUADers base their activity on the requirements of their own work. The RD pattern of adoption makes them use IT technology only as a tool to reach other goals and choose therefore more powerful office tools in their applications. The Utilitarian users and Work enrichers represent this group of persons. They are also more likely to stay in their original job.

4.5 Summary of Data Analysis

This chapter described the EUADers' as knowledge workers in organisation. They are active and innovative workers. Their experiences in using computers and programming are positive. Their computer self-efficacy is also good which means that they rely on their ability to manage with application development tasks. Anyway, they are realistic about their actual possibilities. They think and talk mostly of their actual work and want to develop it. They do not have any special plans with their career as IT professionals.

The applications are mainly developed in order to perform routines at their work. Some of the applications were also developed for use of others. The tools used are mostly office tools like spreadsheets and its macro language. The most active EUADers also use 'real' programming languages like Visual Basic and Delphi. They do not have any systematic development methods. They acquire their knowledge mostly from computer courses, trial and error, colleagues, Help systems and manuals.

They are driven mostly by intrinsic motivation, which drive them to look for new areas to apply the EUAD. Those who are driven by extrinsic motivation like to improve their working practices by making them more efficient. We found two patterns for the process of EUAD: 1) the desire-driven pattern (DD) dominated by intrinsic motivation and 2) the requirements-driven pattern (RD) dominated by extrinsic motivation. Not depending on the pattern applied, they all regard the EUAD activity as interesting and useful.

In addition to the pattern of motivation, we also categorised the informants in four types of the EUADers based on how the person regards his or her activity in the working place. The *inventors* (1) like to develop new applications all the time and this activity also has become part of their work. The *utilitarian users* (2) make the most of computers and regard the IT as just a tool with no other social tendencies. The *work enrichers* (3) enjoy their work and are trying to enrich its content by applying IT to it. Finally, for the *opportunity seekers* (4) the IT plays a special role in their work in relation to their position in the working community. They take it as an opportunity, or he or she has made the opportunity real.

The EUAD can also lead into conflict with the organisation. The most innovative persons whose activity is based on intrinsic motivation, are likely to be driven into conflict with the IT administration. The EUADers with intrinsic motivation are also more willing to seek a job as an IT-Professional.

5 Conclusion and Discussion

The main goals of this study were to analyse and understand the end-users in the learning-intensive working environment. By the first research question we wanted to find out what the EUADers personal adoption process was like. In this chapter we summarise how and why they started the application development activity. In order to answer the second research question, we also shed light on the efforts and strategies in their EUAD activity and found relations inside and outside their working place. Their activity becomes more understandable in the light of their personal background, learning styles, and content of their actual job. Finally, by the third research question we describe the consequences of the EUAD for their work and professional career, as well.

In this section we draw the main conclusions and relate our findings to selected literature. In Section 5.1 we summarise the general findings about end-users as application developers. In Section 5.2 we conclude the key findings concerning the motivation structures and categories of end-users. In Section 5.3 we summarise how the EUAD has affected the work content and the further career of the end-user. The limitations of this study are discussed in Section 5.4 and, finally, in Section 5.5, we give recommendations for practitioners and researchers.

5.1 EUADers as Application Developers

The EUADers in our study were well educated, quite young and mostly males. Earlier studies support the statement that demographic properties like gender, age and education play quite a significant role in the EUC and EUAD (Harrison & Rainer 1992, Schiffman et al. 1992, Munro et al. 1997). These external factors seem to play a significant role in defining the individuals who are potentially becoming EUADers in working life.

The selected persons were generally dynamic and acted with several activities. Also their personal history with computers started in their childhood. Although they were just starting their EUAD activity, their experience, skills and knowledge concerning computers were quite good. The selection criteria ensured that only those persons who also develop applications were selected. Even if the fact cannot be derived from our data, the skills and knowledge on computers has shown to relate to the EUAD activities in other papers (Harrison & Rainer 1992, Munro et al. 1997).

The informants have quite a strong computer self-efficacy (CSE). They all expressed very positive perceptions about their ability to manage with computers indicating their basic reliance on their skills in computer-related tasks. They also think that they, as individual actors, have a significant role in applying new technology. These two factors in our study, computer self-efficacy and willingness to use, work as a necessary prerequisite to become a EUADer in an organisation. This is especially important when we imagine an end-user starting to develop a new system. As the first adopters, they had no supporting colleagues or managers who asked them to develop applications. It was totally up to their imitativeness and self-controlled working practices to start the EUAD activity. Numerous studies have also shown the importance of the CSE in usage of computers especially in tasks requiring continuous efforts (Igbaria & Iivari 1995, Harrison & Rainer 1992, Compeau & Higgins 1991, 1995, Marakas et al. 1998). The CSE-performance relationship is also shown to be reciprocal in nature, as the CSE increases the rate of success, the increased success increases the level of the CSE as well. The CSE is specially needed in early the trials of a new task. In a case where the perceived difficulty, novelty, ambiguity and complexity of the new task can lower the level of the CSE, the initial higher level of the CSE by the EUADers has a significant role in getting the EUADer to try the new challenge.

According to our findings, the EUADers seem to be quite committed to their EUAD activity too. All the EUADers demonstrated their commitment at least in terms of their own work which, according to our categories, indicates commitment at the intermittent level. More than a half of the persons demonstrated their commitment at the highest level. As a matter of fact, the EUAD activity, defined as an active and voluntary use of computers in our study, is very close to the concept of *commitment "as a level to which a person explicitly demonstrates his/her commitment by his/her behaviour or intended behaviour …"* (see sub-Section 4.1). These conceptual definition of commitment is very close to the EUAD activity as shown by empirical findings.

The CSE and commitment of the informants also reflect a positive attitude toward computer technology, the job and the organisation as a whole. According to the first interview, all the informants were happy with their actual job and applying computer technology in it. Almost all of them expressed positive attitude toward their organisation as well. We believe that the positive attitude also reflects the earlier positive experiences in successive usage of computers. People having the competence (computer skills) have also been shown to be more educated and experienced with computers. They also have positive attitudes and low anxiety toward computers (Harrison & Kelly 1992). The positive attitudes toward computers reflect the nature of the EUAD activity as a user involvement in the process of application development. The user involvement has shown

to increase satisfaction (Blili et al. 1998, Rivard et al. 1983), which in turn works for system success as well (Chen et al. 2000). The negative expressions among our data were linked to individual cases in which the application developed was not noticed or even hindered by management.

As individual learners, the EUADers in this study were mostly dominated by accomodator and converger styles of learning. This indicates that they are persons who like to learn new ideas by applying them in practice. They still want to follow theoretically argumented ideas and rules. Engineers and nurses are quite similar as learners (Kolb 1985). They rely, as engineers and nurses, on certain rules and theories when acting and acquiring knowledge. On second thoughts, they are quite balanced: they have features of two other learning styles: diverger and assimilator. This does not indicate that the EUADers totally resemble the computer specialists as learners. The EUADers' learning style is more many-sided: they have features from all other learning styles, too. The reason for this may be the different role of the application development activity: The EUADers practise their activity as an extra, innovative activity in their work, which is not organised by the management. They have to look for new application areas and see their work in a creative way. That is why they also need divergent styles of learning.

Almost all the informants worked for quite a large organisation; seven of them were in the industrial sector and three worked for the public service sector. There was only one person whose working place was a small company. The persons in the industrial sector had technical education.

During the first interview, when the EUAD activity had started, the organisations had big changes in IT. The organisations were introducing new office tools and intranet systems. The IT infrastructure for the organisational information systems was quite ready in the private companies. In the public service sector, computerisation had been introduced quite recently.

The EUADers used either the macro language of office tools or programming languages. The applications developed were mostly for use in their own work. However, some of the applications were originally developed for use of others as well. They also had interesting jobs with quite wide freedom to make their own decisions. More than half of the informants worked in big companies in an industrial environment. The work consisted mainly of controlling and reporting the production and financial functions of the firm. This sample resembles the findings in earlier studies in which finance and accounting were the most widely used application areas in application developed by end-users (Benson 1989, Rivard & Huff 1985, Sumner & Klepper 1987). The work was versatile including tasks which required solving problems and applying their skills in practice. The workload especially concerning the amount of paperwork was at inter-

mittent level but increasing all the time. Anyway, the EUADers still liked their work and saw many opportunities in it. The job in all cases included tasks requiring the ability to apply a certain plan or a rule in the task.

Most of the applications perform analysis of data using spreadsheets and data base processing. This distribution is also similar to earlier findings (Rivard & Huff 1985, Blili et al. 1998, Rockard and Flannery 1983). The tools varied from spreadsheets and databases to programming languages.

The types of the applications made by the EUADers reflect their work content, which includes tasks of planning and analysing requiring problem solving independence for individual decision making. One thing that restricted their independence was the high workload. Also the introduction of organisational information systems worked as a frame for the systems under development.

The development methods were quite unstructured. None of the EUADers used any systematic method. The mostly used method was "trial and error". The data of our study support the earlier findings about the lack of structured methods in the EUAD (Brancheau & Brown, 1993). The usage of different methods in information acquisition varied quite a lot. The most popular methods used were help systems and manuals, but also attending computer courses, asking other people and Internet were used. The inter-organisational mass media, like magazines and journals were not used very much. Only the most advanced EUADers used the printed media.

The biggest problem mentioned was the isolation. The EUADers developed their systems mostly alone. They did not have the courage to ask for help. For instance, they did not even consult the IT professionals even if help was available. The contacts with other end-users were not very useful. Our respondents said to have been more advice givers than advice receivers. Also other problems arose, like organisational disharmony and difficulties in analysis or implementation. They had a high workload and a lot of paperwork. Many of them also trained programming outside office hours. The UDAs seemed to help the EUADers in their routine tasks, but, in spite of that, it did not actually diminish the total amount of work to be done. The EUAD activity takes its time and has the tendency to increase the amount of duties to be attended to as well. The problems were different from the earlier ones. In our data, the problems concerned mostly personal issues like application development, whereas, ten years earlier, the problems were more technical in nature. For instance, ten years earlier the EUADers felt that the following issues were or could be problem areas: security of data, data compatibility with mainframe, training and education, incompatible software, etc (Hackathorn 1987).

To summarise the EUADers as application developers, they are very active and satisfied in adopting computer technology. They have sufficient knowledge and compu-

ter self-efficacy to act as EUADers. They are also committed enough to sustain the EUAD activity. In other words: they have all the features that are shown to relate to computer use: positive attitudes, low anxiety, satisfaction, commitment, and competence.

Their personality as learners is many-sided. The features of all four learning styles guide them in applying theories into practice, learning from practical doing, finding new ideas, and finally thinking these ideas as a whole in theoretical terms. Their jobs in large organisations provide the basic resource and freedom needed in creative working style.

The applications developed reflect their work contents. The majority of them are controlling and reporting data concerning their own work related functions. They seem more likely to seek rationalisation and enrichment to their work than practising as IT professionals. The areas of applications and time points to start the development work are based on the actual work content. Their methods of application development and information acquisition are quite unprofessional. As the EUAD activity is unofficial in nature, they work alone without any structured methods. They rely on information at hand, like help systems and error messages. Only the most advanced EUADers use the professional media like manuals and other printed media.

5.2 Motivation Structures and Categories of EUADers

In this sub-section we summarise and discuss the primary findings about the motivation of the EUADers in our study. We also relate the findings to the most widely known theories about technology acceptance and motivation IS literature.

5.2.1 Earlier Studies about Computer Acceptance

In order to see our findings in a proper light, we firstly preview the earlier studies about technology acceptance in general as well as specifically about computer acceptance. According to these theories (Brancheau & Wetherbe 1990, Rogers 1995, Davis et al. 1986, Compeau & Higgins 1991, 1995) both the external and internal factors affect the individuals as reasons for adoption. Although the external factors like gender, age and organisational culture have been shown to relate to computer usage (Brancheau & Wetherbe 1990), we are specifically interested in the affect of internal factors in this study. This is because of the focus on the personal characteristics of adopters.

The adoption is actually very personal in nature: the user makes the decision to use or not to use new technology. A key factor here is the perception about the technology in case. The adopters bear a certain *perception* about the advantages and

disadvantages of the technology. Rogers (1995) names five characteristics affecting the decision made by the end-user to use the technology: *relative advance, compatibility* (how well the technology meets the users's earlier "values, needs and past experiences"), *complexity* (ease of use), *trialability* and *observability*. All these characteristics are features of the technology itself in the eyes of adopters. The individual adoption process can be divided into five phases as shown in Figure 5.1.

Knowledge → **Persuasion** → **Decision** → **Implementation** → **Confirmation**

Figure 5.1 *Components of Innovation Diffusion Theory (Rogers 1995)*

According to Rogers, the decision to adopt is based mainly on the *knowledge* about the technology in case. Sometimes a need precedes the innovation, but also the awareness of an innovation can create the need to adopt it. In the *persuasion* stage, the individual forms an attitude toward the innovation. This is the stage where the individual selectively seeks information about the innovation. The *decision* stage starts when he or she engages in activities that lead to the choice to adopt or reject the innovation. In the *implementation* stage the individual finally puts the innovation into use. Finally, in the *confirmation* stage the individual seeks to avoid dissonance that may occur due to the implementation. He seeks reinforcement for the decision or may also reverse the earlier decision.

The Technology Acceptance Model (TAM) (Davis 1986) resembles Rogers' process of adoption in its basic structure. The TAM model originates from the social psychological theory about reasoned action (TRA) (Fishbein & Ajzen 1975). TRA stresses the personal and psychological factors of adoption. The behaviour is conscious and intentional by nature. There are two principal factors motivating the end-user to use new technology: *Perceived Usefulness* and *Perceived Ease of Use*. Both of them are external motivations. There still exist two mediating factors toward the Actual System Use: firstly *Attitude Toward Using* and secondly *Behavioural Intention to Use*. The model is presented in Figure 5.2.

Figure 5.2 *Technology Acceptance Model (Davis 1986)*

Davis et al. (1986) have also shown that user intentions predict *the Actual System Use* and the two determinants: *perceived usefulness* and *perceived ease of use* affect the *attitude toward actual system use* (see also Blili et al. 1998). The most significant factor is still *perceived usefulness* (Davis et al. 1989). This factor has a significant effect on the usage of the Internet (Thompson et al. 1998) and on the use of CASE Tools by IS-Professionals (Iivari & Maansaari 1997) as well.

Davis' and Rogers' theories stress the extrinsic factors of motivation in the adoption process. They regard the adoption process as an intended and rational decision. The actor is expected to evaluate purposefully and rationally the advantages and disadvantages of the technology in case. The actor himself is regarded as an objective "mean-end oriented" outsider, even if he or she is observing himself as an end-user of the technology. Being that the case, all the factors that the end-user gives as reasons to use the technology, work as "means" for other, maybe higher "ends". The factors are extrinsic by nature and are characteristics of the technology in case. These include "perceived usefulness", "perceived ease of use", "relative advance", "compatibility", "complexity", "trialability" and "observability".

Davis' and Rogers' theories do not explain what makes the user to perceive the usefulness of the technology nor do they explain the user is ready to accept its usefulness when it is apparent. It has been shown that the economic success does not guarantee the adoption in the long term. For instance, Gill (1996) has shown that even the professional users, no matter how useful the system is, may still not adopt it. In place of adopting, they are very good at naming non-economic and non-technical issues as explanations for their abandonment. In the case of adoption, as shown above, the end-users do not tend to name very eagerly organisational factors, personal characteristics or intrinsic motivation as the reason to use the technology. The extrinsic motivational factors are for the end-user more reasonable reasons to name.

Most of the earlier studies analyse the factors affecting computer use as separate relationships. Social Cognitive Theory (SCT) of Bandura (1986) has a more holistic view about the phenomena. It combines all the factors into a unified theory in which all the factors are in reciprocal dependency affecting each other (see Figure 5.3). SCT has three combined sets of factors: environment, cognitive factors and behaviour, which are engaged in ongoing reciprocal interaction. The users' environment, like pressure or unique situational factors, affects the cognitive and other personal factors. Cognitive and personal factors also are a cause for choosing a certain environment. Furthermore, behaviour is influenced by both cognitive and environmental factors and, in turn, affects those same factors. Two cognitive factors: computer self-efficacy and outcome expectations are given extra prominence. This indicates the fact that, if a person

has a belief that he or she has the capability to perform a particular computer related task, he or she is more likely to use the computer. Additionally, if he or she expects that the outcomes of this usage are positive, he will use the computer.

Compeau and Higgins (1991, 1995,1999, also Pare & Elam 1995) approach the phenomena in the perspective of SCT stressing the cognitive factors, such as *outcome expectations* defined as beliefs about the outcomes of computer usage. Outcome expectations can be related to expectations of improvements in job-performance or expectations of change in image, status or rewards (Compeau et al. 1999). They have shown that the higher the individual's *(job) performance related outcome expectations* are, the higher his/her use of computers is. They also have the concept of *affect/anxiety* to express the user enjoyment of computer use. The outcome expectations are very close to the concept extrinsic motivation and affect/anxiety is very close to the concept of intrinsic motivation in our study. The SCT stresses the reciprocal dependency between the enjoyment derived from using the computer and the outcome expectations of that usage. Like the findings of our study show, they state that the two motivations are strongly linked together: outcome expectations have a significant impact on affect and computer use and the enjoyment derived from that computer use also relates back to computer use. On the other hand, the usefulness and outcome expectations are good predictors of computer use, but, on the other hand, the users are more likely to use the computer if it is enjoyable (Thompson et al. 1998) or if its use just affects the user (Compeau & Higgins 1991, Compeau et al. 1999).

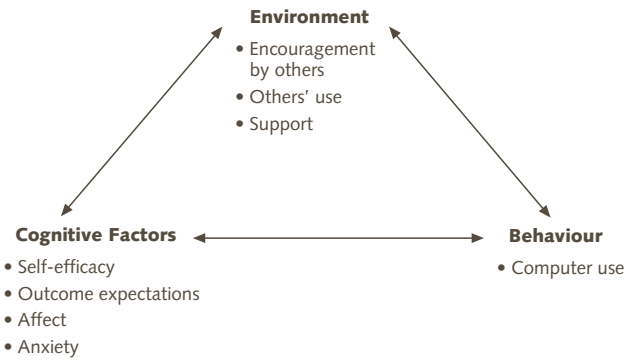

Figure 5.3 *The Social Cognitive Theory - Triadic Reciprocality by Compeau & Higgins (1991)*

We also should consider the user competence as a factor affecting the usage. The people having the competence in computer have also shown to be more educated and experienced with computers. Increasing the user competence in computers can strengthen the computer self-efficacy (Munro et al. 1997) and positive attitudes as well as decrease anxiety towards computers (Harrison & Rainer, 1992). Also these factors are in reciprocal relationship affecting each other (Shiffman et al. 1992).

The computer self-efficacy seems to have a substantial role in the EUADers behaviour. Most of them expressed quite strong confidence toward their ability to manage with the EUAD. All in all, personal characteristics, like perceived consequences and internal beliefs and habits, as well as self-efficacy were the dominant predictors of system use and not the organisational facilitating conditions like the proximity of resources. Also the survey of Brancheau and Brown (1993) shows that managerial actions have certain effect on the end-users' behaviour, but the primary influence on use is elsewhere. For instance, end-user support increases job satisfaction and the control of end users' behaviour decreases it. Still, end-users prefer the informal organisation and look for support more frequently from colleagues.

Although the SCT stresses the personal characteristics (cognitive factors) as a predictor of computer use these factors still are quantitative in nature. A deeper understanding of how these factors work in real working context is still missing. Additionally, the SCT theory does not make any difference between the individuals. The theory does not explain how the factors work with different kind of people in different contexts. The individuals with different characteristics also use computers in a different way.

Another factor that has been shown to relate to computer use is the user satisfaction. Chen et al. (2000) regard it as the most commonly acknowledged measurement of the system success. The concept of affect/anxiety is very close to satisfaction/dissatisfaction.

5.2.2 Our Findings about Motivational Factors

The ruling idea of this study is that the behaviour of an individual actor is based on his/her motivation. All people have their own individual desires to act as they act. Accordingly, we concentrate on seeking the individual, expressed reasons for the computer usage and not so much the factors 'affecting' the usage in the background.

In our data all the informants started their application development on their own initiative. They all had work that gave them the opportunity for the extra activity. The EUAD activity is based on the individual's own willingness to experiment with

something new or to improve their working practices. These factors facilitate the EUADer's basic confidence so that he or she can enjoy it without any risk. In our cases, the organisational factors did not seem to have any significant role in the EUAD.

When starting the EUAD activity the EUADers were mostly committed to their original job. Most of them were actually not very ambitious concerning their plans for the future as application developers. The majority was seeking enrichment and quality for their present work. They regarded themselves more likely as a link between their original job and the IT function. Although many of them had changed their job to an IT profession, they were not actively seeking a new job or a new status in their own organisation. Most of them more likely considered information technology as a trend changing their future work contents and not as a challenge for new job opportunities or gaining more status in their working environment. The follow up interview revealed the fact that, in spite of their earlier intentions, most of them in any case were driven to an IT job. This came up more or less on the initiative of the employer or they were driven into a conflict with the organisation.

There are three basic motivational factors constituting the basis of the EUAD activity of end users. The *intrinsic* motivation rules when the person performs the activity because it is fun or enjoyable per se. When the *extrinsic* motivation dominates, the person is interested not so much in the activity itself but rather in its outcome. The *subjective norm* refers to the situation where the person performs the task because he or she thinks that it is his or her duty. According to our findings, the organisational behaviour is driven by a combination of two motivations: the intrinsic and extrinsic ones. The primary motivation driving the EUADer to start and maintain the EUAD activity is still the intrinsic motivation. The third motivation type, subjective norm, did not actually play a significant role in the organisational behaviour of the EUADers neither in our data, nor in earlier studies (e.g. Davis et al. 1992). This indicates the self-controlled nature of their working style: their activity is based on their own intentions more than organisationally planned procedures.

The role of motivation, especially intrinsic motivation, is not studied very much in IS literature. It is widely acknowledged that the intrinsic motivation, e.g. playfulness and voluntariness, has a decisive role among the Open Source Linux community (see Toralds and Diamond 2001), but the "ordinary" employees working in "real" business are still expected to follow different rules. Most of the recent studies have used research models that stress the extrinsic motivational factors in technology acceptance as described later in this sub-section. In Leino's (2001) complete review of computer acceptance models of 1980's and 1990's, only one of the includes intrinsic motivation as a factor (Igbaria et al. 1995). There are still some studies, which have found the intrinsic motivation as a significant factor in relation to technology acceptance. For

instance, Venkatesh (1999) found the importance of intrinsic motivation during training. Gill (1996) found that the intrinsic motivational factors of job design play a key role in adoption of expert systems. Our study is the first one that using interpretative methods analyses the end-users as personalities trying to find a holistic view about their motivation. Our findings complete those few studies stressing the intrinsic motivation of the most innovative people in technology acceptance in the area of the EUAD.

In most of the interviews the informants expressed both of the two main motivational factors, but usually there was one motivation type that dominated. We analysed the connection of the motivation to other features of the EUAD such as pattern of adoption, tools used, orientation of the EUAD and role of the EUAD for the end user. We found two patterns of adoption in the EUAD processes depending on the dominating motivation. 1) The desire-driven (DD) pattern is basically driven by the intrinsic motivation and 2) the requirements-driven (RD) pattern is dominated by the extrinsic motivation. The end users following the DD pattern have an intrinsic desire to develop applications. They follow the procedure where they firstly (i) search for an appropriate problem to solve, then (ii) implement its solution, and finally (iii) bid for the adoption of the application. The users following the RD pattern usually (i) find a situation in their work context which would benefit from automation, after that they (ii) implement a computerised component and finally (iii) adopt it.

In our study, the adoption of new advanced tools by end-users is one special case of acceptance of new technology in general. We gave one proposition for a categorisation of the EUADers and described how they act with computers in their working places.

Our view is based on phenomenological paradigmatic assumptions about the role of the human being as an actor in the world as described in Section 2.3. From our point of view the individual (end-users) and real world are inextricably related through individual experience. As Sandberg (2000) notes, the worker and work form one entity. The individuals are involved in the world (computer usage) seeing their life-world through their own subjective experience that makes up their pre-understanding about the work. Therefore, they are not quite objective when expressing their perceptions about the phenomena. Their self-reported "perceived" judgement may differ from the objective measurements (Straub et. al. 1995). We believe that the case is similar when giving reasons for their actions. The one that suits life-world best are also more likely expressed. In order to get the right interpretation of the phenomena we have to see the usage in its context and consider what the usage means to the worker in his working life.

How should we then find the real and original reasons for computer use? Which one of the factors, the intrinsic or extrinsic ones comes first, remains as a "chicken

or egg" problem. When asking about the motives, people prefer to give extrinsic rational arguments, such as "usefulness", for their behaviour. The intrinsic motives are more likely expressed besides the other motives, but not as the only reason. In our study the intrinsic motivation is still quite apparent among the persons. When the intrinsic motives dominate, the extrinsic motivational factors come after the decision to adopt the technology. The rational reasons are given afterwards. Moreover, the intrinsic (affect – anxiety) and extrinsic motivational factors (outcome expectations) also have shown to be in a reciprocal relationship, both of them strengthening each other (Compeau & Higgins 1991, Compeau et al. 1999). Anyway, the intrinsic motivation is not always sufficient to keep up the behaviour. A successful adoption needs both of the motivational factors. If the rational reason is not plausible, the behaviour will not last. Heikkilä (1995) puts it as follows: "voluntary use will be sustained if, and only if, it feels beneficial or productive to the user, no matter what the actual reason is" (p. 87).

We also believe that the bigger the innovativeness is, the more the individual is intrinsically interested in the technology per se. The extrinsic motivational factor and also the social norm work more among the late adopters (Rogers 1995 pp. 262). If the person is not interested in the innovation, he or she does not see its usefulness and other extrinsic motivational factors so easily. The intrinsic motivation enables the end-user to work more intensively on the innovation among the more innovative people. The written communication that the more innovative people use (Brancheau & Wetherbe 1990, Compeau & Higgins 1991, Heikkilä 1995) requires more initiative and work than the interpersonal communication that the less innovative people use as the major information channel. The less innovative people also have to be convinced about the importance of the technology and the information system should be more thoroughly designed to be compatible with the workflow of their actual work content in order to guarantee a successful adoption (Agarval & Prasad 1998, Straub et al. 1995).

Abrahamsson (2001) relates intrinsic motivation to commitment. According to his terms, the intrinsic motivation refers to the person's own desire to reach a mental state performing the behaviour not depending on surveillance. Referring to Ryan and Deci (Ryan & Deci 2000, Deci 1975) he notes that the deployment of surveillance can only weaken the intrinsic motivation and never arouse it. The commitment in Abrahamsson's study, like intrinsic motivation in our study, is a category of personal characteristics that cannot be affected by environmental factors. In our data, the independence of making own decisions, intrinsic motivation and commitment are closely linked to the same persons.

For many of the EUADers in our study the reason to start the EUAD activity was based on personal characteristics. Their motivation and development intensity was quite high. All of them also had mostly positive experiences about computers. This must have strengthened their computer self-efficacy, commitment, and positive attitudes toward computers. The computer self-efficacy then affects the intrinsic interest in technology per se. The persons of our study had intrinsic interest in computers. Even the persons following the RD pattern of adoption could have avoided using the computer if they were not interested in using it. In many cases of the adoption the persons were driven to use the computers more or less based on their own willingness.

According to our principal results, the adoption process is very personal in nature. That is; we stress the personal characteristics as the primary factors dominating the user behaviour in the usage of computers. The situations in work context act as an arena where the users can fulfil themselves following their personal characteristics. In other words: the personal characteristics define who are the persons who become EUADers. These persons are intrinsically interested in computing. They try to find either applications to develop or are eager to apply new technology in their work when they recognise a chance for it. To do that they must have some experience of computers that guarantees the basic computer self-efficacy to take the risk that the adoption bears. One significant support to our findings in literature is the importance of personal characteristics in the EU's computer use.

In our study, the users were encouraged to tell the researcher about their work and about what motivates them to develop applications. This guided the informants to focus the motivation more likely to work content than to the tools, programming or other external variables. This difference in methods also causes a different view of the concept of motivation. In spite of that, Davis' and Rogers' theories support our findings about the end-users following the RD pattern of adoption. These end-users started the development after finding a situation in their work context, which would benefit from automation. In other words, they were motivated by the usefulness (extrinsic motivation) of that technology.

The Social Cognitive Theory (SCT) supports our findings on intrinsic motivation and the DD pattern of adoption. The concept of affect/anxiety of the SCT is related to our concept of intrinsic motivation. The same difference in defining the concept of motivation also applies to intrinsic motivation as to the extrinsic motivations above. In the SCT, the respondents name the affect or anxiety as a reason to use or not to use the technology. In our study, the informants had to show the intrinsic motivation either by words or by behaviour revealing the motivation. The intrinsic motivation is close to job satisfaction as well. In our study, the more the EUADers are intrinsically

motivated (satisfied, affected) in using computers the more they also search new possibilities to apply the technology as EUADers using the DD pattern of adoption.

5.2.3 Categories of EUADers

In this sub-section we summarise the categories found among the EUADers. When drawing the conclusion about categories, we think that the most important ones are those relating to the motivation of the end-users. Dividing the EUADers by the tools used in their work, makes the first classification into two categories. The second classification is based on the differences between the EUADers depending on what role the EUAD activity plays in their work. The role of the EUAD activity is the one that connects the usage of computers into its context. The way in which the motivation is actualised, i.e. that tools the EUADer uses and how he or she acts, depends on the work context of the user.

The main goal of this study was to study the motivation structure of end-users as application developers. In this section, we draw the final conclusions from how we interpreted the cases exposed in our data. As a principal result, we state that, in order to understand the end users as pioneers in adopting computer technology we have to learn their personal characteristics and see their courses of action in the light of motivation. We also determine that the motivation is not a simple one-sided factor driving the behaviour, but more or less a combination of the intrinsic and extrinsic motivations working simultaneously.

The motivation that makes the end-users to develop applications seems to be mostly based on intrinsic factors. Although the extrinsic motivation is expressed clearly in the data, the desire to try and use the advanced features and programming languages is apparent. The cases still indicate the fact that the intrinsic motivation is not sufficient enough to ensure successful adoption. No application was developed "just for fun" without taking it into use. The EUADers were actively searching for appropriate areas for their applications. Both motivations must exist as a requisite factor for that EUAD activity.

The first classification includes two groups of end-users. The 'Power Users' have gradually started to use an office tool like spreadsheets or database program in their organisational tasks. Their usage of these tools is connected to their own work context and the activity is mainly based on extrinsic motivation to computer-supported routines. They look for a rapid advantage and want to be sure that the application also proves itself to be useful. They use mainly the RD pattern of adoption. The 'End-User Programmer' people are those who are interested in the application development itself. They mainly

use the DD pattern of adoption by actively looking for application areas to create. Their motivation is basically intrinsic because they are interested in programming and information technology as a whole. This group of EUADers focuses on the application development itself and not so much on the work they are doing. This perhaps explains our finding that they develop applications for others, too.

Flensburg (1986) points out the final intention of the end-user. The concept of 'intention' works in a similar way as the concept of 'motivation' of our study. The issue of tools can be interpreted in the light of intentions of the actions made by the end-user. The real aims of the actions should be the subject of interest and not the tools used. According to him, the tools are not the subjects of choice but they mediate the actions of the end users. For instance, the 'Power Users' choose office tools because they suit best their intentions to get their tasks done and 'End-User Programmers' choose programming languages because they can enjoy programming and develop all kinds of applications for others. In this sense, the tools have no contribution on what the users are aiming at in their work.

The second classification relates to a more holistic interpretation about the role of technology for the end-user. The EUAD activity plays different roles depending on the person and his work context. The role of the EUAD works differently with persons in relation to their status in the working community. We found four roles for the EUAD. In each of the roles, the EUAD is significant, but in a different way.

The first group, (i) the *inventors* are EUADers for whom the EUAD activity has become a part of their work and hobby. They follow the DD pattern of motivation and like to develop applications for others, too. These people are technically oriented and have also had computer related hobbies in childhood. The second group, (ii) the *Utilitarian Users*, use the EUAD just as a tool. They want to alleviate their work by automating routines. These people are mostly business oriented and use the computers mostly for accounting. The third group, (iii) the *work enrichers*, consists of people who want to make the work more interesting by applying new 'trendy' tools. They also have some 'playfulness' at their work. Finally, (iv) the *opportunity seekers* are people for whom the EUAD gives a chance to gain significant advance in his or her position in the working community. They usually take the EUAD activity seriously and are ready to work for it.

In the earlier studies the users are mainly categorised based on the types of tools used or on their organisational tasks. McLean (1979) found three types of users: DP Professionals, DP amateurs, and non-DP trained users. Rockard and Flannery (1983) categorised the users into six groups (see sub-Section 2.1): non-programming end-users, command-level users, end-user programmers, functional support personnel, end-user computing support personnel, and DP-professionals. Rivard and Huff (1985) found three

categories: Micro DP Department Users, Staff Analysts, and Opportunity Seekers. McLean's and Rockard and Flannery's studies covered the whole area of users. Rivard and Huff 's study covered only those users who also developed applications including persons who did it as part of their duty. The EUADers in our study covered only voluntary users who also developed applications. In our study, the EUAD had a special, personal motivation to start the EUAD activity. We eliminated those individuals who did not develop applications or who developed applications as part of their organisational duty. The persons of our data covered only the 'DP amateurs' in McLean's, and the 'end-user programmers' in Rockard and Flannery's study.

The categories found by Rivard and Huff are closer to our findings. Our categories cover the 'Staff Analysts' and 'Opportunity Seekers' of their study. Rivard and Huff's 'Micro DP Department Users' includes users "who respond to requests from other users". They were in principle not included in our study because they develop applications as their formal duty. However we have to notice that the job among some of our EUADers changed towards a direction that the job finally resembled the description of 'Micro DP Department Users'.

The Staff Analysts consist of users "who perform studies that are used by other managers to control, plan or make decisions". "They develop applications that they themselves use to solve problems". This group resembles our Utilitarian Users. They use computers for the same type of tasks. The Utilitarian Users in our study were both using the computers for business planning and financial analysis.

The second type of Rivard and Huff: "Opportunity Seekers" consist of persons "who have considerable expertise in their own function and who often work in a managerial capacity such as a supervisor or a budget director… They are more independent, more creative and proactive". "They also actively identify problems. They are 'rising managers' who view computer related skills as a job asset providing a relative advantage in their work". These people correspond quite closely to the people in our category with the same name. Our Opportunity Seekers differ in their organisational status. The persons in our study did not (yet) work in managerial capacity in areas of the 'complex analysis of data'. They were more technically oriented people who developed mainly transaction processing systems or database systems for organisational use. The future professional career of Opportunity Seekers of our study shows that they more likely wanted to do real IT tasks than become managers in their own area.

Generally there are still some differences between our and Rivard and Huff categories. The categorization of Rivard and Huff, as well as McLean, and Rockard and Flannery described above are mainly based on the characteristics of the job and the types of applications and tools used. The commonly used method was survey. Rivard and Huff

also conducted personal interviews to explore the entire concept of the EUA. None of the earlier studies has stressed the personal motivation as we did in our study. We tried to find out the intentions of the end-user and what he or she is aiming at. This being the case, the fundamental classification criterion in our study is the intention of the EUADer and how the EUAD activity in his or her work context can help him or her to fulfil that intention. In other words, our main criterion of classification is the motivation of the EUADer and not what he or she is actually doing. Therefore, it is difficult to compare our categories to the ones in IS literature. The same person with the same job characteristics who is categorised as Staff Analysts in Rivard and Huff's study can be an Inventor, Utilitarian User, Work Enricher or Opportunity Seeker depending on his or her personal motivation to develop applications. If he or she is intrinsically interested in computers and just likes to try all new things in his/her workplace, he or she is categorized as an Inventor. If he or she just wants to perform his or her actual task more efficiently, he or she is a Utilitarian User.

5.3 Consequences of EUAD

In this sub-section we firstly summarise the consequences of the EUAD activity on work content at an individual level. Secondly, we discuss the implications at the organisational level. Accordingly, we describe the role of EUADers as change agents, knowledge creators and actors in core capability development. We also discuss the findings in the light of modern job design.

5.3.1 Implications of Work Content and Career

The EUAD activity had many implications of the work contents of the EUADers. When the EUAD activity was noticed, they usually got more and more computer related tasks. The new tasks were mainly related to the maintenance of company computer systems but, they were also asked to develop applications for organisational use. Anyway, the tasks were mostly in their own work area.

The new tasks also made the jobs more versatile and demanding requiring problem solving and freedom to make their own decisions. They could apply and implement ideas into practice. The applications were mostly developed to help in performing routine tasks like calculation and retrieval from data base systems. The applications were developed both for the use by themselves and also by others. This also helped the end-users to diminish the amount of paperwork considerably.

Not depending on whether the job was administrative or technical by nature, it consisted of a lot of paperwork. The number of tasks in supervising and reporting tended to increase due to the EUAD. This also increased the total amount of work to be done. The interviewees seemed to take that with no dissatisfaction. This is understandable because of the nature of the EUAD as a voluntary choice.

The learning of new tools and programming took a lot of time. The im-mediate effect on the work content appeared when the EUADers tried to manage the extra workload. The most used manner was to work during the off-office hours. Some persons worked at home during weekends. Many of them put more focus on the development work leaving some tasks to others. Most the informants were also allowed to do so.

There was also one group of EUADers for whom the EUAD activity caused contradictions as well. These persons were the most active ones of the group 'EU programmers' and were also seeking an IT-profession as described later.

Generally, the the EUADers regarded the effects as positive. They could enrich their work and gain more contribution and status in their working environment. This caused more job satisfaction.

The long-term effects of the EUAD were considerable in many senses. Six of them changed their jobs and there were also considerable changes in the work content of the rest of the interviewees. The willingness to leave the original job was not expressed in words in the first interview; quite the contrary, the EUADers gave reasons why they do not want to leave their jobs. We interpret this phenomenon so that the persons were actually interested in their original job, but still maintained an intention to apply for an IT profession, too. The actual willingness to apply for an IT job could be revealed using a longitudinal study in which persons were interviewed again more than three years later. The follow up interview also validated our earlier interpretations about the individuals' personal intentions concerning the EAUD activity. The transition from the EUADers to an IT profession was quite significant. Six persons changed their job to IT profession.

Based on the cases in our data, the intrinsic motivation towards application development seems to be the primary reason for the transition of the EUADers from their original jobs to IT professions. Almost all the persons were satisfied with their job and there did not exist any perceptible reason in the organisation to leave the job. The real reason seems to be in personal characteristics and motivations. These persons had during the first interview an intrinsic motivation to develop applications. They mostly used the DD pattern of adoption. The intrinsic motivation could also be seen in the tools used: they all used professional programming languages as their tool to develop EUAs. Three of them were categorised as an Inventor, two as an Opportunity Seeker and one as a Work Enricher.

The persons working in the industrial sector seemed to be willing to look for an IT profession. They also worked for big companies that could also give more opportunities for changing the job. For some of the future IT professionals the new work also meant promotion. The Inventors and Opportunity Seekers seem to be that kind of EUADers who have external goals outside their actual job.

The EUADers working in administration, research and education did not seem to be willing to change their jobs like those EUADers working in industry. They were more interested in developing their actual jobs than in seeking an IT profession outside the organisation. Also their willingness to stay in their original job can be explained by their motivation. Their motivation was extrinsic in nature. They followed the RD pattern of motivation in the adoption process. They also used tools that indicate more interest in solving problems in their work than a desire to develop applications. Two of them were categorised as Utilitarian Users, one was a Work Enricher and one was an Opportunity Seeker. The EUAD activity also seemed to be short-lived by nature. As the software tools and organisational infrastructure matured, the Work Enrichers and Utilitarian Users also decreased the EUAD activity. The reason for that in our data was the introduction of more advanced systems in administration. There was no need to develop systems anymore.

Much has happened since the introduction of microcomputers and end-user computing in 1980's. We are now shifting from "the computer-entered technologies to network-diffused technologies" (Castells 2000). The network includes the network ties as social capital (Nahapiet & Ghoshal 1998) as well as network channels. The Internet is commonly acknowledged as the most important facilitator of the Information Age. New applications extracting the Internet technology are emerging all the time. Examples of that are Internet based applications, mobile technology and GPRS. We think that the EUAD activity still has a role to play. It can fill the gaps that the commercial applications always leave. Like our EUADers filled the gaps of computer-centred technology, the EUADers of today will create applications serving the ever-increasing need of communication for the Information Age.

5.3.2 Organisational Implications

5.3.2.1 EUADers as Change Agents

The EUADers as early pioneers of new innovations have a significant role as change agents (Brancheau & Wetherbe 1990) as well. They are opinion leaders, who are active in seeking information and learning new things. They also use mass media and inter-organisational

communication channels. They were not so active for asking advice or help from others. They brought the technology even without the support of IS department. The EUADers were willing to adopt the new technology from their peers and not very eagerly from organisational arrangements (Rogers 1995). This was also the case in our findings. The original reason to start the EUAD activity came from the initiative of the EUADers. The organisation mostly took a neutral stance to their activity, but when the usefulness of their applications became clear their activity was acknowledged.

In order to successfully implement an IT-related change in an organisation, many things have to be considered. The Magic Bullet Theory (Markus & Benjamin 1996, 1997) postulates that the changes in IT technology can not alone change the organisational behaviour into a desired direction and prevent people from working in an old, unproductive way. The IT specialist who builds the systems acts therefore as a change agent and is responsible for the change. Markus and Benjamin show that the reliance on technology's power alone has caused many failures. It can happen that both line managers, users and IT specialists believe in IT's magic power with the consequence that nobody takes the responsibility for the successful implementation of the change. We should accept the fact that it is the people, not technology, who construct the organisation and also create the change in it.

The successful implementation of organisational change needs one group of people taking a special role as a change agent responsible for the change (see Heng et al. 1999, Damsgaard &. Scheepers 1999, Bharadwaj et. al. 1999). Markus and Benjamin (1996, 1997) introduce two alternative roles for change agents in addition to the traditional role as an IT expert being responsible only for the building technology. Firstly, the change agent can act as a *facilitator*, which means that he or she empowers and facilitates people to create change and does not do it by him/herself. The second role, *IT-advocate* focuses more on inspiring people than empowering. Acting in this role, the change agent "shocks" people by demonstrating effective behaviour, convincing them through constant repetition and uses all tactics that work, even legitimate organisational authority. They can be found in every organisational role and with or without organisational legitimacy.

The EUADers act in many senses as the "change advocates". They are willing to change working practices and very likely demonstrate their ideas. There are also many differences. They work in the user organisation as 'ordinary' users. They have started the EUAD activity from their own initiative and do not have any organisational legitimacy as acting change agents. They are more interested in their own working practices and not necessarily willing to change other peoples' working practices. Even the management does not necessarily know their activity. They still could, if properly organised, act much more effectively also as change agents.

Markus and Benjamin state that "both mid-level line managers and IT specialists can play the IT change advocate role" (1997). Their concept about the change agent bears the idea of organisational authority or expertise at a certain level. They have control responsibilities and could more successfully act as change agents. As they cited, "Change flows best across a helping relationship". The change agents should therefore be as close as possible to the users and committed to change in their organisation. The EUADers are people who work in the user organisation and they could act as change agents too. The management could more support their activity in order to facilitate creativity and adoption of IT. Their role could be that of a Trojan horse in the user organisation for realising change.

The EUADers could also be added as an additional group of agents. As the 'change advocates' in the study of Markus and Benjamin act as managerial agents, our EUADers act as self controlled, innovation seeking actors. They are change advocates, but with the difference that, their activity is voluntary and not organisationally planned.

5.3.2.2 EUADers as Knowledge Creators

In the situation where knowledge and competence at work constitute one of the most important aspects in contemporary organisations, we have to consider how our findings relate to the theories of organisational learning. Thus, we have to analyse how the EUADers contribute as learners and creators of new knowledge in organisations. In this sub-section we relate our findings to the recent theories about organisational knowledge creation. We firstly relate the findings to Nonaka's (1994) theory that is perhaps the best known theory in this area. After that we have a look at our findings in relation to the recent refinements of Nonaka since its introduction (Nonaka & Takeuchi 1995, Crossan et al. 1999, Cook & Brown 1999, Brown & Duguit 2001, Järvinen & Poikela 2001).

In the IS science the concept of knowledge has been subject to continuous development during the ten years. While the traditional epistemology emphasises the absolute, static, and non-human nature of knowledge, the modern organisational theories see knowledge as a dynamic and human process of justifying personal beliefs (Nonaka 1994). Although the learning process is basically an individual process, however it also takes place in an organisation within a group of people. Organisational learning is a process in which an organisation creates new innovations and adopts new practices. The success of the organisation depends on its capability to react to environmental changes and learn from them. As the operations of an organisation are based on its own knowledge available, the success of the company is also dependent on how well the company is capable of acting as a learning organisation.

According to Nonaka (see Figure 5.4), all knowledge is originally created in the minds of the individuals. As long as it is not (yet) formalised and systematised, it is called *tacit knowledge*. Tacit knowledge is originally created from experience. It works when people work and make decisions, but they cannot necessarily make it explicit why they do as they do. Tacit knowledge covers the internalised work in the daily working context. *Explicit knowledge* covers all knowledge that is in written or in other transferable form. Explicit knowledge can be discussed and analysed in the organisation and transferred in order to create new organisational knowledge.

Knowledge is individual when only a very limited set of people uses it. It is organisational when it is widely acknowledged throughout the company. When organisational knowledge is concerned, the whole organisation works on the basis of this knowledge. It is usually written in explicit form in company documents and databases. Also organisational knowledge can be tacit. This is closely linked to the concept of an 'unofficial' or 'social' organisation. The people in the organisation can act in the same way in certain situations even if it is not officially acknowledged in the company.

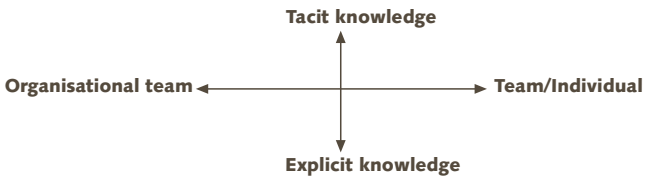

Figure 5.4. *Nonaka's (1994) Two Dimensions of Knowledge Creation*

Nonaka (1994) summarises the organisational learning as a process of four knowledge conversions from one form into another. In the *externalisation* (1) process the individuals, based on their tacit knowledge, try to articulate and formalise their views into explicit form in teams and organisations. The process continues in the *combination* (2) process where the people in organizational meetings combine different bodies of explicit knowledge to form explicit organisational knowledge. The *internalisation* (3) process bears the individual learning in which the people make the organizational knowledge work as tacit knowledge in daily routines. The people also learn from each other in the *socialisation* (4) process in which they acquire tacit knowledge from shared experience of organisational routines.

The further refinement of the theory (Nonaka & Takeuchi 1995, McDermott 1999, Nonaka et al. 2000) shows how important the context or, 'ba' as they call it, is in the knowledge conversion process. The ba works as the platform for knowledge conversion and a space for self-transcendence. In this sense the middle management has a very important role as 'knowledge producers' in energising the ba that needs a safe and creative atmosphere for interactive knowledge sharing. This implies supporting autonomy, creative chaos, redundancy, requisite variety, love, care, as well as trust and commitment. New ideas emerge in the "conflict of perspective, the clash of disciplines, the murky waters at the edge of science…" (McDermott 1999). Creativity is embedded in all stages of the knowledge creation process.

Crossan et al. (1999) and Järvinen and Poikela (2001) have developed an overall framework for the process of organisational learning to encompass the different roles of individual, group and organisation. According to their framework, the learning process works at three levels: individual, group and organisational. According to Crossan et al. the process starts from the individual level as *intuitions*. All new insights and innovative ideas occur to individual persons. This is a process of learning where the learner bases his/her learning on his/her own experiences. Intuition is basically subconscious and tacit by nature. When acting in new situations, the learner in the situation perceives both similarities and differences through his or her earlier experiences. In order to get the intuition about how to act in the situation, the learner uses two strategies of intuition. Firstly, when recognising similarities, the learner uses a *pattern recognition strategy* to act out the situation. This is the way in which the experts normally act. The other key to intuition, called *entrepreneurial intuition*, is to recognise the possibilities in the differences of the situations by making novel connections. This intuition has more to do with innovations, change and possibilities. Expert intuition is past pattern oriented, whereas the entrepreneurial innovation is future and possibility oriented.

At the second stage of the organisational learning process, the individuals *interpret* the situation. It is a conscious process to develop the cognitive map about the domain guiding the interpretation. Interpreting is explaining the situation through words or actions. This is the stage where the actors give names, meanings and connections to the concepts in explicit form. The same phenomenon can produce different interpretations among persons.

The interpretation process is a necessary base for the third stage of the organisational learning process where the individuals *integrate* the situation at group-level to evolve a shared understanding about it. It is done with a continuing conversation in workgroups and communities. Language helps the individuals to share and create new meanings and practices. At this stage the meanings and actions become collective and coherent.

Finally, *institutionalising* sets learning apart from individuals. In order to accelerate the ongoing process of explorative learning and also to ensure the exploitation of new ideas in business practice, organisational learning has to be implemented in daily organisational routines. Learning should be embedded in organisational systems, strategies, and prescribed procedures.

Järvinen and Poikela take these theories together forming a holograph describing, not only how the learning process works at different levels, but also how these three levels are bound together constituting the organisational entity (see Figure 5.5). At the individual level the learning follows Kolb's experimental learning process of Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualisation (AC) and Active Experimentation (AE). Accordingly, the same process of learning takes place at the group level. The stages are named as Sharing of Experience (SE), Reflecting Collectively (RC), Combining New Knowledge (CK) and Learning by Doing (LD). Finally, at the organisational level the process is defined as Intuition Formation (IF), Intuition Interpretation (II), Integrating of Interpreted Knowledge (IK) and Knowledge Institutionalising (KI). All these activities between individuals, groups and organisation are going on at the same time vertically in which the social (CE-SE-IF), reflective (RO-RC-II), cognitive (AC-CK-IK) and operational (AE-LD-KI) process follow, influence and shape each other in a process of continuous learning.

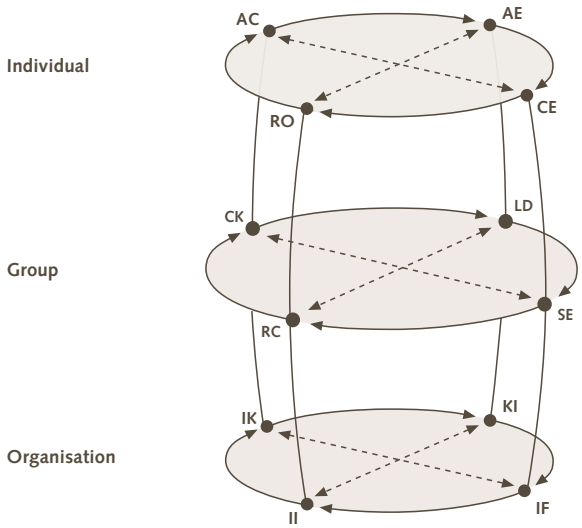

Figure 5.5 *Järvinen and Poikela's (2001) Process Model of Learning at Work*

How does the EUAD activity contributes to the organisational knowledge creation in the light of organisational learning? Accordingly, what roles do the EUADers play in the four processes of knowledge conversion, and at the three levels of organisation? Finally, what is the 'generative dance' in the case of EUAD activity?

The EUADers in our study were quite many sided as learners. Although our EUADers are good at each of the four stages of learning at the individual level, they were especially good at active experimentation and concrete experience. As converger style of learners (AE), the EUADers apply new ideas to see if they work in practice. In order to find an idea about how to apply the technology, the EUADer needs *intuition* to some extent. The innovation of this type can also have features of Crossan's 'experts pattern oriented' innovations. The EUADer differs from the 'real' expert's intuition in two ways. Firstly, due to the lack of experience of the EUADers, the development methods and methods of information acquisition were quite unprofessional by nature. Secondly, the EUADers' 'patterns' are created and shaped by the logic of that particular application area whereas the patterns of the IT experts are more or less generalised ideas used in earlier application design. When the IT skills develop the EUADers learn to apply the patterns in new situations in their application area. That develops the professional skills and the ability to create professional patterns of intuitions in new situations. This can lead the EUAD to increase the intensity of the EUAD activity and continuously seek new ideas of applications as it was among the EUADers following the DD pattern of adoption.

The intuition of the EUADer can also be "entrepreneurial intuition" by nature. They are the first to recognise the possibilities of IT technology in new situations. When having the knowledge of application development, they can make novel connections between technology and the work context. That indicates reflective observation (RO) to recognise the ideas that also work in practice. If the EUAD knows that a particular task can be done more intelligently using a new application he or she is also ready to start to develop the application.

Of course, a great deal of the EUAD consists of pure training and learning the skills of application development as well (CE). Moreover, the EUADers cannot compete with the IT professionals as application developers without having a new idea or invention embedded in the application. Therefore, the intuitions of the EUADers have more to do with innovations, change and possibilities than applying of patterns of experience.

At the group level, the EUADers' role depends on how widely their ideas and experience is shared among peers. In our findings, most EUADers' ideas originate from the individual acquisition of knowledge. The EUADer *interprets* the new application idea and makes it explicit in the group by implementing the application. The application itself presents the explicit form of the new idea. The contact with the group members takes

place when the application is ready. The new system acts as a 'shock' (Markus & Benjamin 1996) demonstrating a better business practice. In many cases, the implementation of a new application is the best and maybe only way, to get the idea through.

The EUAD activity can help the individuals to *integrate* the situation and combine new knowledge (CK) at group-level. The managers and fellow workers do have to discuss the innovation in the form of application. If the innovation is successful, the application is also taken into use. The usage of new applications works as a tool to generate new business practice. The applications were also used in the organisation. In this sense, the EUAD activity generates, at its the best, "learning by doing" (LD).

In the light of organisational learning, the ideal situation is that the EUADers and the other group members could "reflect collectively" (RC) the application as early as at its development stage. In our data, most of the contacts were taking place at the CK stage when the application had already been implemented. The EUADers act quite alone with their development work having not very many contacts to other application developers as well. This caused contradictions at the CK stage when the others did not have any chance to contribute to the application at the earlier stages.

The role of the EUAD is not very significant at the organisational level. The institutionalising stage of Crossans' model was not reached by most of the cases in our data. Many of the applications were designed for their own use only. Many of the new applications were also replaced later by business application packages. Additionally, the change of business practice at an organisational level by the exploitation of a new EUA needs organisational support to the extent that we cannot regard it as EUAD anymore.

Cook and Brown (1999) (see also Brown & Duguit 2001) have developed the theory further by reinterpreting the principles of knowledge creation. As Nonaka emphasises the circular nature and the four distinct conversion processes of knowledge creation, they put all the four processes together forming one dynamic process. However, they have a totally different view towards the nature of knowledge and also the nature of how new knowledge is created. They emphasise the distinct roles of the four categories of knowledge each doing their own epistemic work. Each form of knowledge needs to be understood conceptually as distinct and even if they have equal footing, each does work that the others cannot do. All the four categories also have a significant role in the learning process. These dimensions act simultaneously in the process where the knowledge of one form is used as a tool to generate the knowledge of another.

They put significant emphasis on practice. They also make the difference between the static part of knowledge that is *possessed ('know that')* and the dynamic part of knowledge that works as *part of* the action itself. The latter form of knowledge, called

knowing, bears the idea of the real use the of knowledge in practice ('*know how*'). Knowing is that part of knowledge that makes the knowledge work in practice. Knowing is situated and actualises in the organisational context. The 'know how' is characterised as a knowledge about the process in which you know how the variables affect the result (Bohn 1994).

The knowledge creation process takes place when knowledge and knowing are in reciprocal interplay in which knowing uses the four static forms of knowledge as a tool to generate new knowledge. The process of knowing, in which these four forms of knowledge do their epistemic work, constitutes a *generative dance* where new knowledge and innovations are created. According to Cook and Brown, the individuals and groups use knowledge in the interaction with the social and physical things and activities of the world. The individuals do not use all of the knowledge as part of their actions, nor as the individuals possess all the knowledge used in actions. Anyway, the knowledge frames the actions of the individuals.

They reinterpret Nonaka and Takeuchi's (1995) case about how new knowledge is created in the development of bread-making machine. According to Nonaka and Takeuchi's view, the knowledge creation is a circular process where the master bakers' tacit knowledge is converted into explicit form. The knowledge in this case is owned by different people and also resides different forms. The program designer went to the bakers in order to acquire this knowledge. What is central is how the tacit knowledge owned by the master bakers can be converted into explicit form in order to use it in software development.

Cook and Brown interpret the case differently. The team as a whole to produce the machine used both bakers' tacit knowledge, and engineers' explicit knowledge to produce new knowledge. The teamwork enables to build a situation where the people can work within a "productive inquiry". The team drew on all four types of knowledge. It is a typical case of an instance of bridging epistemologies.

In the previous interpretation the tacit and explicit knowledge possessed by two different professionals is used as an aid to produce explicit knowledge of the other professional. The case of our EUADers is similar in the way that in both cases new knowledge is produced in an explicit form stored as a new product or tool. The case is still different in two ways. Firstly, in our case the process is basically individual in nature. There is only one person producing the new tool using his or her tacit (and explicit) knowledge about the working practice and the explicit (and tacit) knowledge about the software tool to produce the explicit knowledge. Secondly, our EUADers are doing two different process of knowledge creation simultaneously. In the first process, they are learning to use the software tool and in the second process, they are creating a new

application for usage in their work. The first process, the explicit knowledge in manuals and other documents, is used as a tool to create new tacit skills to the software. In the second process, the tacit knowledge about the working practices is used as a tool to produce explicit, fixed, procedural knowledge about the working practice.

The creation of knowledge should be internalised as an inseparable part of daily business processes. The role of the EUAD is still quite important. It is mostly active experimentation at individual level. The EUADers also raise new ideas from their intuitions and, if they trust on the availability of it, implement them into real applications. In this sense, they act as key agents for the success of innovations. The early pioneers play a key role in this process as knowledge creators. As the end-users adopt new technology and exploit it into practice, they are also creating new knowledge and practices in the organisation. Anyway, the EUAD activity is also risky. The pioneers act in an uncertain situation where the benefits of the adoption are not always clear. The probability of adoption depends on uncertain profitability estimated in terms of the value of the innovation (Heikkilä 1995, p. 142). The role of the management is to provide a safe and supporting environment to reduce the uncertainty.

5.3.2.4 EUAD and Core Capabilities

In the previous sub-section we described how the EUADers contribute to organisational learning. According to the modern resource-based view (RBVF) of the firm, it is the knowledge that is the essence of firms making them to be different actors in the market. Consequently, the privately held knowledge is the basic source of advantage in competition (Conner & Prahaland 1996). That calls us to see how the EUAD activity can create knowledge that also has strategic potential and how the applications developed in our cases are used in organisations.

Andreu and Ciborra (1996) studied the development of organisational learning in the light of capability development. As knowledge and work practices are closely linked to the organisational learning they also contribute to the successful progress of the company in the form of creating new capabilities in the long run (Figure 5.6). They propose an organisational learning model based on the RBVF concepts about how individual usage of resources is linked to organisational strategy in the form of core capability development. According to their framework, the capability development starts from the usage of standard resources in the working context. A successful learning to use resources in the working place will transform them into new organisational capabilities. The capabilities are faced to the competitive environment and when having strategic

potential they will be transformed into core capabilities. As the firm's competitive success lies in its daily practices and usage of knowledge, IT becomes an active component embedded in its core capabilities.

The strategic aim of the firm is to develop core capabilities from its resources (Andreu & Ciborra 1996, Barncy 1991). That directs us to focus on the characteristics of these resources in order to identify if they have strategic potential to become one of the core capabilities. In this sense the capability must be:

1) *valuable:* it exploits opportunities and/or neutralises threats
2) *rare:* the number of firms possessing this capability is smaller than needed for perfect competition
3) *imperfectly imitable:* the others cannot imitate it perfectly
4) *with no strategically equivalent substitutes:* there is no alternative way of achieving this advantage

The organisational transformation process starts from bottom up with the resources available. The resources are combined and used in daily work routines or use process. The firm learns from these routines and becomes also dependent on them (path- or acquisition-dependency). The output of this process is a new or refined capability. Those capabilities that meet the specifications listed above become core capabilities. The firm can acquire new capabilities only through its own transformation process. The path dependency makes the capabilities difficult to imitate.

The creation of new capabilities is a learning process. The inimitability and path-dependency make it useful in the business competition. The process constitutes a triple loop learning process (see Figure 5.6).

1) In the *routinisation loop*, one learns to master the standard resources and creates efficient work practices.
2) In the *capability learning loop* one learns to combine work practices and generalise them by putting them into a new context. In this loop, new and refined capabilities are generated.
3) In the *strategic learning loop* one creates new core capabilities. In the light of competitive environment and business mission, the firm realises that some capabilities have strategic potential and learn to take the advantage of it. In this framework, the capabilities get their meaning. In other words, people understand not only *what* and *how*, but also *why* they do certain things.

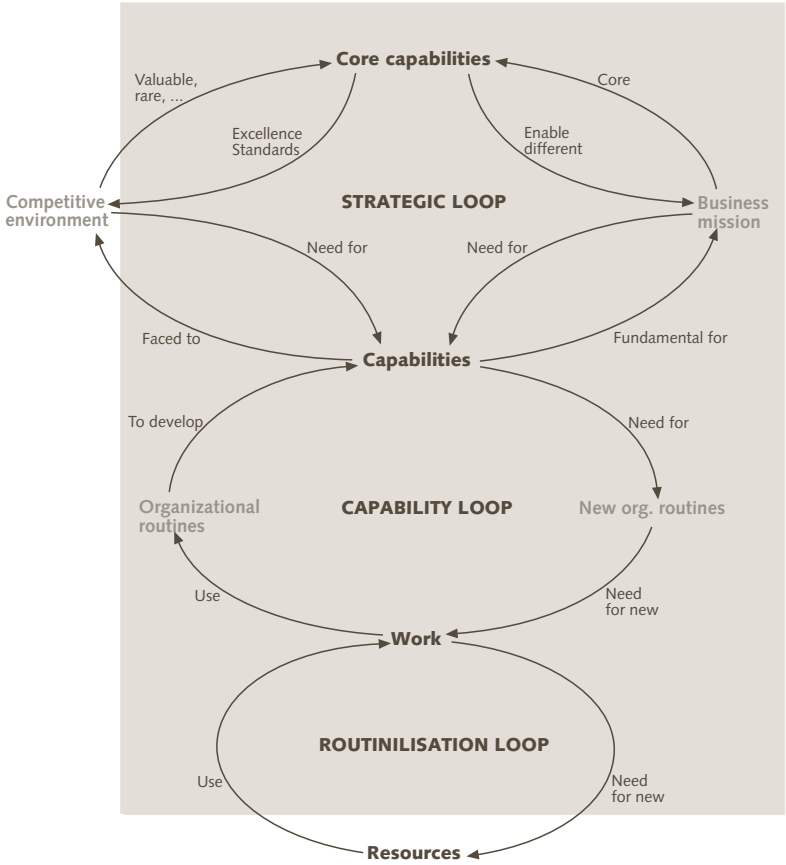

Figure 5.6 *Learning of Capabilities and Core Capability Development Process (Andreu & Ciborra 1996)*

The capabilities are rationalised work practices in which the knowledge has a central role. Three of the features (rare, imperfectly imitable, with no strategically equivalent substitutes) of the core capabilities are of such a nature that they cannot be copied from others. They have to be created in the company's own process of knowledge creation. To show the contribution of the EUAD to Core Capability Development, we should show that the resources generated in the EUAD process have strategic potential, in other words, they are valuable, rare, imperfectly imitable, and with no strategically equivalent substitutes.

The triple loop learning process of core capability development from resources, through capabilities to core capabilities seems to take many EUADers a long time. In our data, most of the EUADers prepared applications for own use and they did not work on with applications having wide organisational importance. The majority of the EUAs were small and created specifically for use in their own work. Some of the EUAs were used, and some of them were also originally designed for the use of the whole organisation. Especially the applications solving specific technical problems were widely used in organisations. These applications can be considered *rare* and *valuable* in the sense that they were not available in market. Still we cannot state that these applications alone constitute a capability that is also *imperfectly imitable* and does not have any *strategically equivalent substitutes.* Instead of that we can conclude that these applications together with the expertise of these persons in the application area, especially in persons D and H constitute a capability that can have strategic potential. They developed applications that needed a lot of expertise in the application area. Maybe these applications would not have been invented without their intrinsic interest in application development. Also the administrative EUAs had strategic potential at the organisational level. The new stock- control system made by person H was certainly an improvement. The system for historical archives, made by person C, originally started from a small idea about how the customers inside the premises of the archives could search archive documents. Later on, the idea was expanded into a project that resulted in an application that enabled the usage of archive documents via Internet.

In order to gain strategic business value from IT, the firm has to focus, in addition to competitive environment and IT acquisition and deployment, also on the use process. Impacts occur when people and organisational units use IT assets (technology and skills) appropriately (Soh & Markus 1995). The adoption process leading to competitive advance has to start early enough before the competitors. In order to aim strategic advantage, the end-user should also participate in 'capability loop' by developing new organisational routines. These routines can later be transformed into capabilities and, if they have strategic potential, also into core capabilities. The earlier the right resources are exploited, the more they have strategic potential. In the case of early adoption the management policy plays a significant role. In the case of the EUAD the user has to take a risk by investing his or her time. The learning and information gathering is costly in relation to the benefits for the individual adopter. Anyway, the adoption may be useful for the organisation. In this case, allocating resources to the EUAD can reduce the risks of the individual end user. The situation becomes more complicated in organisations of experts. In these kinds of organisations the innovator is usually the only one who knows the expected value of the innovation. The intrinsic motivation is a good driving force to ensure early adoption that sustains the activity.

The commercial applications offer solutions that are based on business practices used in a wide rage of companies. The rare solutions that do not have a market have to be developed as in-house applications, that the EUAs also represent. In that sense these applications developed by end-users are rare. Moreover, the applications made by experts in that application area usually embed task specific knowledge. The EUAD is a way to store the experts' knowledge for more powerful use by him or her self and other fellow workers. In this sense, the applications can store rare knowledge and also embed rare business practices. A rare application together with embedded knowledge in it is imperfectly imitable, too. The companies applying new practises have to implement the needed applications in-house.

The EUAD activity also has a general effect on the flexibility of the firm to react to environmental changes. The flexibility effect accounts for the relative costs in order to incorporate learning or unexpected opportunities arising during the course of work (Conner & Prahaland 1996). The flexibility effect of the EUAD activity works at its best in the cases where the IT can be of good use but no ready-made application is available. A motivation to develop an in-house EUA can solve the problem at hand. Even if the problem is temporary by nature or a commercial business application may replace the EUA later, the EUAD activity still fosters the learning process and solves the problem at hand. In our case, the application made by person G to organise the students of different options into groups solved one, although temporary but still apparent problem at hand.

5.3.2.5 EUAD and Job Design

The EUAD bears the idea of a voluntary and free working environment. The end-users have one part of the job content in their own hands. Also the job theorists have developed principles of how the job should be designed. In this sub-section we analyse how the EUAD activity relates to the best-known theories about good job design. We are interested if the EUADers are creating their work content towards the direction of a good job design. Especially, what is the contribution of the EUAD activity to work satisfaction and performance? In this sub-section, we relate our findings to the job design theories presented in Buchanan's study (1979 Part 2).

A basic philosophy of job design theory implies that more satisfaction can be derived from work where the structure of tasks is designed as to increase the commitment of the individual, to facilitate his utilisation of a wider range of skills and increase the scope for him to relevant areas of decision-making (pp.1). Buchanan categorises the job design theories into four generations depending on their maturity. In this study, we

compare our findings mainly to the 2st, 3rd and 4rd generation theories (4GT) because they correspond best to the principles of our findings.

The first and second-generation theories (1GT, 2GT) bear the central idea about the importance of matching the job characteristics with employee characteristics. These theories were created as a response to the problems caused by the increased mechanisation of the production after the Second Word War. The 1GTs regarded the poor output of performance as animplication of task specification and monotony. A monotonic task with no choice of tools or methods and decision-making causes decrease in output. The solution suggested (Viteles 1950, Stephens 1962) was *job rotation* and *job enlargement*. The increased variety of work was supposed to increase satisfaction and job performance as well.

The 2GTs put more emphasise the complex nature of work. According to these theories, the characteristics of a job include much more than just a variety of different tasks to do. The job content incorporates characteristics which can be used not one to enlarge the job horizontally, but also vertically, or in other words, to *enrich* the job. Katzell et al. (1961) suggest a multivariable approach to job design. According to him, the output of the job is mainly dependent on the work environment and the employee's characteristics together, as intervening variables, with the employee needs and expectations (Figure 5.7).

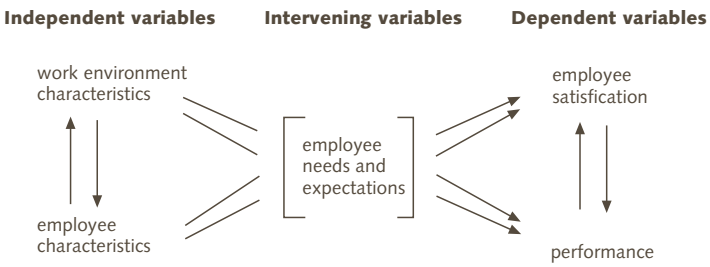

Figure 5.7 *Model of the Work Situation: Second Generation Theory (Buchanan 1979 p. 33, Original Source: Karzell, Barrett and Parker, 1961)*

Figure 5.7 indicates that the employee satisfaction increases job performance and vice versa. The model emphasises the employee and work environment characteristics as the most important aspects shaping employee needs and expectations. The way to increase job performance is to develop the job characteristics in variety, autonomy, interaction opportunities, responsibility, and learning time (Turner and Lawrence 1965). This vertical job enlargement is called '*job enrichment*' (p. 35).

The third generation theories (3GT) developed the tradition of job enrichment. The theorists of 3GT described the human nature and his desire for psychological growth. Hence, a good job design covers, in addition to the analysis of work content, the analysis of the basic human needs as well. The people satisfy different needs in their work and the job satisfaction constitutes a combination of needs to be fulfilled. Even Maslow (1943) described how man satisfies his needs in a specified order from basic needs concerning existence like sex, hunger, thirst and oxygen to the higher order needs concerning self actualisation (existence, security, social, esteem and reputation, autonomy and self-actualisation). This indicates that the factors affecting the higher order needs do not work until all the needs at the lower levels are satisfied. The 3GT research also shows how the events leading to job satisfaction are different from those leading to dissatisfaction (Herzberg, Mausner, and Snyderman, 1959). The '*motivator*' job content factors: achievement, recognition, responsibility, advancement, growth and the work itself e.g., contribute to job satisfaction whereas the '*hygiene factors*' like salary, company policy and administration do not actually relate to job satisfaction, but can anyhow cause dissatisfaction.

The human being is described as having the '*basic needs*' and the need to satisfy the desire for *psychological growth*. The people are also different in their structure of needs. The research also shows the existence of two types of workers: 1) the '*hygiene seekers*', and 2) the '*motivation seekers*'. The difference between these two groups lies in how they are motivated in their work. The motivation seekers are internally oriented and show a higher degree of job satisfaction whereas the hygiene seekers are externally oriented people for whom the job is only a provider of means for promoting extra occupational goals.

According to Herzberg (1966) there are two sets of psychological needs: a) constant need for cortical stimulation and b) need for psychological growth. The latter need consists of six characteristics:

Cognitive characteristics:

1. knowing more
2. acquiring relationships in knowledge
3. creativity

Motivational characteristics:

4. effectiveness in ambiguity
5. individuation
6. real growth (perception of reality, self perception)

The position of job enrichment in 3GTs is summarised in Figure 5.8.

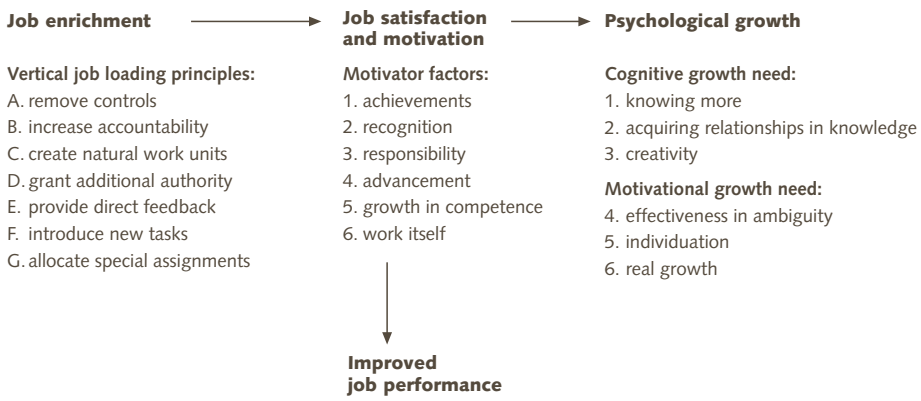

Figure 5.8 *Job Enrichment in 3GTs (Buchanan 1979 p. 43, Original Source: Herzberg 1966)*

The fourth generation theory (4GT) research continued the job enrichment research by creating the expectancy theory of motivation (Buchanan 1979 pp. 63-84, originally invented by Toman, see Hilgard & Bower 1975). The 4GT emphasises the conscious nature of human behaviour. According to the theory the people are rational and conscious when performing their acts. People set their goals or, as they call it, 'valences' and evaluate their individual probabilities to achieve these valences. The valence refers to the anticipated satisfactions to be gained as outcome for the action (Buchanan 1975 p. 64). The outcomes vary from social respect from fellow workers to concrete rise in payment.

The 4GT theorists analysed the factors affecting the individual probabilities and valences. The individual probability to perform an action is influenced by the individual's self-esteem and previous experiences. The valences refer to the extent to which the outcomes satisfy the needs of individuals. The 4GTs state that there are three critical psychological states effecting the motivation and satisfaction in job: experienced meaningfulness, experienced responsibility and knowledge of results. A good job design

can affect the valences of the job, in other words, designing the job to satisfy the needs of individuals will also increase motivation. A good job design accounts for the following five core characteristics: skill variety, tasks identity, task significance, autonomy and feedback from the job itself. The list is quite similar to the motivational factors of 3GT in figure 5.8.

It seems apparent by 4GT researchers that the intrinsic rewards which a well-designed job can offer are more important than extrinsic rewards. The intrinsic motivation satisfies the high-level employee growth-needs and the rewards are controlled by the individual self and not by others. The 4GTs propose also similar changes in nature as 3GTs: combining tasks, forming natural work units (create natural work units, increase accountability), establishing client relationships (remove controls, grant additional authority), vertical loading (introduce new tasks, allocate special assignments), and open feedback channels (provide direct feedback).

To summarise the progress of job design theories in the light of what has shown to motivate people and what changes in job characteristics they propose, we can say that the theories have put more and more emphasis on psychological factors in the job and its capability to satisfy human needs. The picture of human beings has also become more sophisticated and the people are also more seen as different in their motivational structures. The importance of motivation has got more and attention. The 1GTs and 2GTs did not have any explicit theory about motivation. The 3GTs had a two-factor theory of motivation stating that the motivator or job content factors effected job satisfaction and the hygiene or job context factors effected job dissatisfaction. Finally, the 4GTs stressed the importance of the critical psychological states effecting the motivation. They regarded the intrinsic motivation as important to perform well in a job.

We can view the EUAD activity in the light of job enlargement and enrichment. The EUADers are really enlarging and enriching their jobs through 'new tasks' and 'special assignments'. The new tasks also 'form natural work units' with actual job content. New EUAD tasks require new skills. They are also 'removing control' by increasing individual decision-making in the area of choosing tools and methods. The satisfaction of the employees in our study is apparent. When having the opportunity to enrich the work content, they did it on their own initiative.

The technique of job enrichment lies primarily on the statement that the job should be adjusted to meet the characteristics of human nature. It is also emphasised that the need for psychological growth dominates the majority of the employees. This is especially true among the EUADers in our study. Three groups in our study, the job enrichers, inventors, and opportunity seekers are motivated mostly by the factors of job satisfaction and motivation. Only the utilitarian users are motivated more on hygiene

factors such as usefulness of the tools used. We can still expect that the utilitarian users are not only hygiene seekers, because their personal investment causes more work and new responsibilities. The EUAD activity produces also psychological growth although the activity is argumented by its usefulness. The job enrichment principles come true on their own, especially in the introduction of new tasks and allocation of special assignments.

We have to point out, that these intrinsic motivations can be found mainly among the most skilled employees. As indicated in the research of 3GTs, the unskilled employees still place more value on extrinsic job components (Buchanan 1979, p 48, Centers & Bugental, 1966). It is also true that the intrinsic motivation is tied to individual differences and sub-cultural influences on the individual's behaviour at work. The workers' need for psychological growth is actually not innate by nature, but it can also be just actualisation of middle class values that human beings acquire through socialisation at work.

We have to notice that the EUAD activity is only a part of the EUADers job and therefore does not cover the whole motivation structure of the job. For the inventors and opportunity seekers, the EUAD activity plays a more significant role than for the work enrichers or utilitarian users. The two latter groups seem to seek higher satisfaction more from their actual work contents and its higher level of performance.

5.3.2.6 Conclusions

To summarise, we can say that the basic issues and structures of knowledge and information in an organisation have become a fundamental asset and can also become a core capability of the company. We have stressed that knowledge differs essentially from the traditional resources. Knowledge is to be handled more as an organisational asset than just as a cost factor. It is fundamentally social by nature and the knowledge in an organisation is internalised in its everyday operations. Knowledge mainly resides in the heads of the staff members and in the daily practices of group behaviour. The management of this resource is also strongly related to the management of human resources in the social context. The management has to consider the individual acceptance of new technology and also the knowledge creation in the whole organisation. The company has to create the strategically significant knowledge by itself in the learning and knowledge creation process at the organisational as well as at the individual level.

Learning sets new challenges for organisational management, too. The process of learning cannot be planned in the traditional sense. When having a 'goals-end' view towards organisation, no learning takes place (Weick 1990). The actions are organisa-

tionally planned beforehand as 'best practices' and the organisation is not implicitly prepared for change. Learning should be "insinuated into the fabric of life" (Senge 1990a). Learning, knowledge and innovation are inseparable components of an organisation. They cannot be acquired from outside, but the organisation has to be made to learn, create knowledge and innovate. According to Senge (1990b), leadership starts with the principle of "creative tension". It links the vision to the current reality. The leader is principally a "designer" of the organisation and not a captain or commander.

The human beings are active by nature and seek psychological growth in their work. The social esteem and reputation, autonomy and freedom, and finally, competence and self actualisation needs are important in order to understand a persons' behaviour in his or her job. Esteem and reputation drives the person to search a high level of self-respect, and respect from others. The self-actualisation need drives the person to actualise his or her personality in the world. Like the writer who has the desire to write, the workers have the desire to put their personal mark in the work. They want to customise their working environment and procedures. In our study the *inventors* are the persons driven by the self-actualisation need. The love, affection and needs for belongingness and esteem are the ones that drive the *opportunity seekers, work enrichers* and *utilitarian users.*

In a post-modern society, information plays a central role in knowledge-intensive work. Because the staff members actually bear this knowledge in their heads, it makes the human being and his/her motivation to work for the company the most important factor in the working life. Therefore the organisation has to be taken more as a social structure among people than a technical structure of responsibilities. This changes the nature of the organisational power and control structure. People cannot be managed only through formal control mechanisms which are based on extrinsic motives like rewards. It is more a management of organisational culture and values. Kirsch (1997) has found that the internalised organisational culture, for instance in the form of pressure by peers, works very efficiently without needing any formal control. When the organisational culture rewards and enforces individuals' intuitiveness, the people are even ready to set up a 'self-control' mechanism to set their own goals and rewards.

In traditional information systems science the organisation is taken as a stable system, consequently, there is no need to make any major changes in IS systems during their lifetime (Truex et al. 1999). It is a managerial issue to decide what information systems developed by end-users are accepted for organisational use. The task of the IS management is mainly to 'support' the end-users to use the organisational guidelines and not to let the end-users to develop their own systems.

As the organisational processes are constantly changing and the information systems are increasingly embedded into the business processes, they should also designed

together with these processes. The information systems should be flexible enough to adapt to the changes in business processes. These systems should also be designed to recognise the interests and incentives of the users participating in the process (Ba et al. 2001).

The learning of organisations ensures the continuous and ongoing renewal of organisational practices. New ideas rise from the organisational context and stay alive if they are perceived useful. That is the case also in the IT related activities like information systems design. The use of IT is one of the organisational activities and the changes in organisational practices also change the IT related practices. The ISD should not seek the delivery of a stable IS product to users, rather it is related to the delivery of the ISD dialectic service that continuously adapts the existing IS (Truex et al. 1999). As McLean and Kappelman (1993, also McLean et al. 1993) suggested, the end-user computing is becoming a direct extension of corporate computing. The EUAD supplements the traditional ISD and helps a firm to quickly react to emergent IS needs. The EUAD is therefore not just creating tools for the end-user himself self or for others, but rather, it is adapting and developing organisational practices in the area of IT related practices. The organisational policy to support the EUAD is not just letting the end users to develop their own applications, but seen in a wider perspective, it is supporting innovation and knowledge creation in the organisation. The EUAD is therefore a part of organisational knowledge creation.

5.4 Assessment of Validity and Reliability of the Study

Although significant progress in the validation of instruments has been found in IS research (Boudreau et al. 2001), there is still a call for efforts for better quality. This is especially true concerning qualitative studies because the evaluation of quality is more problematic than it is in quantitative studies. This is because the researchers using qualitative methods usually rather search for the understanding of phenomena than put a focus on rigorous quality assurance. However, the quality should be assured in qualitative studies, too. An agreement has not yet been reached on how it should be done.

There is a fundamental difference between these two research traditions concerning the concepts of quality. Quantitative methods use rigorous statistical calculations whereas qualitative methods rely on deep-analysis and argumentation. The results of quantitative studies can also be validated using mathematical calculations whereas, in qualitative research, the quality assurance process is "qualitative" in nature. The quality is an entity, comprising the researcher, the research process and the research report itself. In qualitative research, the relevance of the results has a high priority. The researcher

should select a topic that is influential in the eyes of practitioners and describe the results in a manner that could be put to use. Also research reports synthesising the existing body of research or stimulating critical thinking are considered to be relevant (Benbasat and Zmud 1999). In qualitative research, the definition of the object is important. The description of the object is always a theoretical task, because it is a conceptual analysis of the object (Mäkelä 1990). The relevance of the research is based upon the deep-analysis and argumentation rather than on the use of rigorous "scientific" methods.

The quality of the research is related to the *generalisability* of its results. There are several types of generalisations depending on the type of the study. The way, how the theory is generalisable depend on how its results are generated. The researcher has to be aware about what kind of generalisations can be drawn from the results of the study. The research becomes generalisable because the mechanics of using its results is apparent Baskerville (1996). In other words: the results must be *relevant* and *practicable (transferable into practice)* (Aaltonen 1989, Lincoln & Cuba 1985 pp. 124).

Patton (1990 p. 461) links the quality of research to credibility by listing three inquiry elements:

1. rigorous techniques and methods
2. the credibility of the researcher
3. philosophical belief in the phenomenological paradigm

Cummesson (1991 pp. 186-187) expresses the same principles but in a more detailed form. Three of the principles are directed at the researcher and five at the research itself.

1. the readers should be able to follow the research process and draw their own conclusions
2. the researchers should present their paradigm and pre-understanding
3. the research should possess credibility (correct data, analysis and interpretation, etc)
4. the researcher should have had adequate access to the processes under study
5. there should be an assessment of the generality and validity of the research
6. the research should make contribution to increased knowledge and relevant problems
7. the research process should be dynamic
8. the researcher should possess certain personal qualities

We start the assessment of the quality of our study by shortly discussing our study in the light of Cummesson's criteria. After that we will discuss the quality criteria presented in terms of *validity* and *reliability* as defined by Yin (1984).

Cummesson aims three of the criteria at the researcher and five at the research itself. The first criterion for the researcher (criterion 2) deals with the presenting of the paradigm and pre-understanding. As presented in sub-Section 2.3.1, we took a subjectivist approach to the reality, analysing the social world as it is in the mind of the subjects. We also believe that the subjects are autonomous and free-willed by nature.

Concerning pre-understanding, the role, training, experience and personality of the researcher are important in the interview. I, as a researcher, have been a lecturer in computing for some twenty years. During these yeas, I have had an opportunity to get to know youngsters and adults starting their careers as IT professionals and trained end-users. As part of my work, I have been able to visit numerous companies when following the development of my students doing their practical training in business. I could realise how seriously the students took their jobs in order to give the best contribution they were able to. I think that this experience provides a good pre-understanding about the phenomena under study.

Moreover, even if I am a lecturer in computing, my role towards the informants was neither that of a supervisor nor that of a teacher. The informants had already left the university and none of them studied in our faculty. I also introduced myself as a researcher and not as a teacher doing research. Only two of the informants knew my being a teacher before the interview took place.

The fourth criterion requires the researcher to have adequate access to the data. I interviewed the persons twice and contacted them afterwards to crosscheck my interpretations. I did not have any limitations concerning the access to the data.

The eighth criterion concerns personal qualities like commitment, integrity and honesty, flexibility and openness, etc. As to evaluating myself in regard to personal features like this, I can only say that this research work has been part of my work and I have tried my best.

The first criterion targeted at the research report concerns the readability of the study. The reader should be able to follow the research process and his or her own conclusions about the data presented. To write the report keeping this aspect in mind, requires introducing the informants and their activities as well as possible to the reader. The meaning of their actions should become clear. In our study, the stories of the informants are presented in Section 3.2. To support the transparency of our argumentation from the data, we also took a lot of quotations from the stories.

The third criterion concerns the credibility of the correctness of data, the analysis of the data and the interpretations made. This is a matter of presenting sufficient support for the correctness of the data, for argumentation and for the interpretations made. The study should include all the necessary and relevant data and information used in a case study. This criterion is very close to the quality of the research as a whole. In our study, this is done in Chapters 3 and 4, where the stories of the informants are represented and analysed.

The fifth criterion about the generality and validity of the research requires clarifying the area that the results apply to, how closely the results represent the phenomena and how they confirm or disconfirm earlier findings and theories. This criterion is done in Chapter 5. We compare our findings with existing literature comparing our findings of EUADers, their motivation structures and other factors affecting the usage.

The sixth criterion concerning the contribution and the relevance of the problem is presented in the introductory chapter of the study. We think that the modern organisations increasingly need ideas and methods to support the initiativeness and innovativeness of knowledge workers. We think that the key issue in this sense is to keep up creativity and motivation among workers.

The research report has also been dynamic and subject to continuous critics. I have been working with this research for seven years giving presentations about the study in four different seminars in Finland and the UK. I have also got comments and critics. My supervisor has read and given comments on seven versions. I have presented and published one research paper about the subject of this study in Greece (Rantapuska et al. 1999) and the preliminary results of the study are published in the licentiate thesis (Rantapuska 2000).

To make a more complete analysis of the quality of the research, we have to discuss the study in terms of validity and reliability. The validity refers to the extent to which the researchers are able to use their method to study what they had sought to study rather than studying something else (Gummesson 1991 p. 91). The validity deals with the semantics of the data. The theory, model or concept must accurately describe the reality (Baskerville 1996). The validity is linked to the term "trustworthiness" (Lincoln & Cuba 1985 p. 290).

The reliability refers to the extent to which two or more researchers studying the same phenomena with similar purposes will also yield the same results (Gummesson 1991 pp. 91). The issue of reliability is also problematic with case studies. In order to be reliable, the same results should be achieved by other researchers as well. In most cases that is impossible because of the dominant role of the human component in collecting and interpreting the data.

Yin (1984) sets the criteria for judging the quality of the research design by classifying the quality into four components: *construct validity, internal validity, external validity, and reliability.*

The *construct validity* refers to the correctness of the operational measurements for the concepts being studied. This is regarded to be problematic because of the human component in the data collection.

The *internal validity* originates from nomothetic inquiry and it usually assumes a causal connection between two variables. In conventional terms, the internal validity is defined as the extent to which variations in a dependent variable can be attributed to controlled variation in an independent variable (Lincoln & Cuba 1985 p. 290). That being the case, the internal validity is a concern only of causal and explanatory studies and not of explorative case studies such as ours.

Yin proposes that the internal validity, for case studies, may be extended to the broader problem of making inferences. In case study research, the researcher "sees" connections between the events in the data. How well the researcher is able to find all the rival connections and how well he or she can make the right interpretations depends on the analytic skills of the researcher.

The external validity deals with the problem of knowing whether the findings are generalizable beyond the immediate case. The external validity is very important when trying to apply the results into practice. The way in which the results are generalizable in qualitative studies differs from that of quantitative studies (Baskerville 1996). There is also a call for using different terms with qualitative studies. Patton (1990 pp. 486-487) uses such terms as extrapolation, participation and generalisation in naturalistic inquiry instead of generalisation. Extrapolations are modest speculations of the likely applicability of findings to other situations that are similar, but not identical, conditions. Extrapolations are problem oriented, based on information-rich data targeted at stakeholders' concern about the present and the future. The external validity, interpreted in this way, is highly respected in qualitative studies. The researcher should help the stakeholder to see the similarities and differences between theory and practice. That is, the researcher should write the research report in a manner that the reader can follow how the general case has been generated.

The assessment of *construct validity* is considered to be problematic. Yin suggests three tactics to increase construct validity: first, by using *multiple sources of evidence*, then, *establishing a chain of evidence* and finally, having the draft case study report *reviewed by key informants.* The nature of our study studying motivational and attitudinal factors does not allow us opportunities to use so many sources of evidence as it the case may be with other case

studies. However, during and after the interviews I collected evidence whenever it was possible. During the interview, I made extra questions to ensure that I also understood the informant correctly. For instance, when talking about application development using a named programming language, I asked the informants' opinion about the tool used. This gave an impression about how advanced the usage really was. I also asked the informants to demonstrate the applications whenever they were available. The follow-up interview and crosschecking also gave me the opportunity to review the earlier interpretations.

The establishment of a chain of evidence means having an explicit link between the questions asked, data collected and conclusions made. In Section 2.2, we present the questions and reasons for each of them in order to link these questions to the result data representing the findings of the study.

Concerning the third tactics, the informants reviewed the preliminary descriptions about them. The findings were discussed with one of the key informants.

Internal validity in case study reports may be extended to the problem of making inferences and interpretations about the events under study. According to the nature of the study, it represents one possible explanation of the truth. There are several plausible interpretations about the phenomena based on the same data, of course. According to Kvale (1987 p. 46-47), the question becomes more complex when the issue investigated is not only the *area* of reality, but also involves the *nature* of social reality. There is also a significant distinction between the *observed* behaviour and the *interpreted meanings* given to the behaviour investigated.

Some of our interpretations have a direct connection to the original data. For instance, the persons following the DD pattern of adoption also expressed the events of adoption in the story in the same order as described in the pattern of adoption. Some other parts of the theory require more interpretations about the actions from which the theory is created. For instance, the four categories of the EUADers: inventors, opportunity seekers, utilitarian users and work enrichers, were created based on the situation of the person, the nature of the EUAD activity and the way in which the person described him or herself as an EUADer. These categories are interpreted meanings for the actions of the persons.

We think that the meanings given to the actions seem to make sense. The activity as a whole is describable through the categories created in the study. We also think that the theory is internally coherent and is not in contradiction with itself. In our study, the follow-up interview gives an opportunity to check if the interpretations made from the first interview are in contradiction with the later behaviour.

The external validity deals with the problem whether the audience of the study can find similarities in the phenomena described with the cases in which they use the

results. Our study describes motivated and innovative people who are trying to contribute to the working community by creating EUAs. The study concentrates on the structure of motivation that, we think, is one of the key issues in knowledge-intensive working environment.

Although this report certainly demands concentration from the reader, I still think that I have managed to create a picture of the motivational desires of the EUADers. The further researchers, as well as practitioners, can read the report following my argumentation in order to draw their own conclusions for their own 'goal cases'. This, I think, fulfils the requirement of contribution.

Reliability is problematic in the case studies in which the data consists mainly of interviews. The stories should be stable over time, not depending on the time, place or the personality of the researcher. Interviews are limited sources of data because participants can only report their own perceptions and perspectives. The stories are subject to distortion due to personal bias, anger, anxiety, politics and simple lack of awareness (Patton 1990 p 245). In order to get a picture about the reliability of the study, we should analyse the circumstances of the interviews in our study. In spite of the problems, the method used in observations and the time when the observations were made should have a high reliability in the case studies (Baskerville 1996).

In our study, the circumstances of the interview were arranged as relaxed and confidential as possible. The informants chose the time and place for the interview. Most of the interviews took place after working hours when the informant was not busy. The informants were also informed about the confidential nature of the interview. The researcher pointed out that he would not contact the employer to ask for any further information. To ensure that the first interpretations were made correctly, the descriptions of the informants were crosschecked after the interviews had taken place. The informants read trough the description about them and made some corrections, too.

The follow-up interview gave a chance to see if the first interpretations were right. I could see quite a long period of the working history of the EUADers. All the informants were also willing to take part in the follow-up interview. This fact, I think, supports the assumption that the informants also told the truth in the first interview not hiding anything.

There might also be problems with the reliability in our study, of course. Argyris (1991) showed that what the people believe and what they actually do, do not match very well. The people consistently act inconsistently, unaware of the contradiction between what they say (exposed theory) and what they actually do (theory-in-use). In our study, for instance, the informants said that they were not going to leave their jobs to become IT professionals. In spite of that, many of them found themselves in an IT

position. However, the problem is not so big because of the research topic of the study. We were mainly asking about the motivational desires of the persons, in other worlds, what they *think* to be reason for what they do and not what they actually do. It is a challenging task to verify if the informants are telling the truth or not.

5.5 Limitations of the Study

In this sub-section we discuss the limitations of our study. The main problems of our study concern with the issues of interpretation, other ways of obtaining data, similarities of organisations, representativeness of the sample.

The issue of motivations is complex and not easy to interpret. In our study, almost all informants expressed both intrinsic and extrinsic motivation. They all showed general intrinsic motivation toward computing itself but when they talked about an individual case in their work they emphasised its usefulness in their task. People tend to give rational argumentation for their actions. Which one is the dominating motivation resides finally on the interpretation of the researcher. On the other hand, it is difficult to interpret what actually has been the object of the interest. Are the EUADers really interested in the application development or are they just interested in applying technology in their work? In the latter case, the real object of the interest is the content of the work. It is impossible to make the difference between the work content and the embedded technology in it. The usage of computers is as much work content as technology.

The interpretation of what is the dominating motivation is easier when the EUAD is seen in the context of actions, such as the tools used, the purpose of the application, and in the context of how much the EUADer is ready to invest in his or her activity. Those EUADers who used the office tools showed mostly extrinsic motivation and used the RD pattern of adaptation. The EUAD activity was also closely linked to one's own tasks. They did not have to invest their time to excess, either, but could develop the applications little by little and also get results immediately. The situation of these EUADers who used programming languages was quite the contrary. They used the DD pattern of adaptation and prepared applications for others, too. They had to work very hard to get the application to work. They also used their leisure time most of all.

This study aimed at describing the EUADers' world-view. The results are based on the interviews of those persons who also wanted to take part in the study. This voluntariness can also cause extra enthusiasm in their expressions. The informants may have tried to present their role in a better light than is the case in reality. A study about the persons related to the informants as employers or peers may have given extra infor-

mation about their 'real' motivation or role in their working community. Moreover, other ways of obtaining data, such as company documents or observing the participants in their working environment would have provided more details about the phenomenon. A more holistic picture about the implications of the EUAs would have been interesting to analyse. For instance, our data based on the end-users own perceptions, does not provide appropriate data to analyse how these applications effect the companies' competetitiveness in business in the long term.

The organisations selected present mostly the manufacturing sector and organisations which are actually not 'knowledge intensive'. Certain industrial areas representing more knowledge intensive industries e.g. banking, insurance and trading or expert organisations e.g. universities are missing. The persons were in a working situation where the computer technology in the office was quite new and they could really quite easily get the status of change agents or innovators in their organisations. Anyway, many of the persons interviewed were working in jobs where their daily duties took most of their time. The real opportunities to actualise themselves as EUADers was quite limited. That also caused transfers from their job as we found in this study. More participants, especially among young managers in knowledge intensive industries, could have eliminated this problem. What could have happened and how they would have acted as EUADers, in a situation where their employers could have let them develop their original work content would have been interesting to find out.

The number of informants was also quite limited. As Sandberg (2000), referring to Alexandersson (1994) has noted, to reach the saturation point, the number of participants should be at around 20. In our study the increase of participants would have deepened the picture about the EUADers as a whole. But, on second thoughts, the grounded theory research method used is so time-consuming and laborious that the increase in the number of participants would have increased the work too much.

5.5 Recommendations to Practitioners and Researchers

In the light of our findings, the practitioners have a variety of possibilities to prepare the organisation and working environment to encourage innovative usage of computer technology among end-users. It is important to pay attention to the basic assumptions that managers have about their staff members as human beings and to what drives them when acting in an organisation. According to our view and findings, we recommend a democratic and flexible stance for managerial philosophy. That means the assumption that people have initiative, are responsive and self-directed as learners and members in

an organisation. Accordingly, the role of management at its best is to provide the workers with good working conditions to develop, learn and self-actualise in their job.

Especially in the case of information technology, the EUAD activity should be encouraged. It produces effective learning and innovations. As the people learn, self-directed, in the real working context, they also voluntarily develop their working methods. That causes commitment and flexibility to react with turbulent environmental changes.

Effective learning and diffusion of innovations also need flexible and human-centred organisational culture. As Napiet and Ghoskal (1998) have stressed, the social network is the necessity to create intellectual capital. The lack of social network hinders the flow of innovations and supportive behaviour in an organisation. As the findings of our study show, the isolation of the EUADers is one of the biggest problems among the EUADers. The management could solve this problem by creating a working community of end-users in which the participants could support and learn from each other. This kind of a community is a good way to foster creativity and diffusion of innovations. In this point we have to make the difference between the organised, technical end-user support services and peer support in working teams. The support in teams is content-dependent problem solving, whereas the end-user support service is basically maintaining the infrastructure of general help in their technical problems to end-users. The end-users need, besides learning in the workplace, formal classroom training as well. Especially, the new office tools and programming languages take their time from individual training.

The management should also identify the different types of the EUADers in teams. A working team should have different kinds of members with different roles. The Inventors and Opportunity Seekers are that kind of end-users that can produce creativity. The Work Enrichers and Utilitarian Users can encourage the implementation of daily routine work. The EUADers, especially the Opportunity Seekers and Inventors should have enough challenges in their job so that they would not take up new positions as IT professionals in other companies.

There is also a need for a more flexible strategy of organisational IT policy. One traditional role of the IT function has been to automate routine work by implementing company level information systems. In addition to this, the IT-function should also give space to the EUAD activity and propose application areas that need automation. For instance, there are huge amounts of data in the corporate databases that the EUADers could make good of use by implementing reports and preparing applications for the analysis of that data. The management could train the EUADers to implement applications to retrieve and process this data.

Another issue is the policy of software and tools used. The EUADers, especially the Utilitarian Users and Work Enrichers need software that is flexible and easy enough to develop the applications in small pieces. Learning in the workplace is most effective when the worker can see the results quickly. The software used should also cover the whole team. That guarantees the diffusion and learning from others either at a vertical and horizontal level in an organisation.

This study proposes some challenges for further research, too. As an interpretative study, our results represent more likely a proposition for a theory than a final one. Our answers also raise new questions to be paid attention to. The two limitations described above: the limited number of informants and knowledge intensive organisations of the study also offer a challenge to test and complement our findings. The studies can test and complement the main results of our study. We mention some challenges that we consider the most interesting ones.

- Does the general finding about the dominance of intrinsic motivation really work? Which factors relate to intrinsic and which factors to extrinsic motivation?
- Do the RD and DD patterns of adoption work? What patterns do the end-users with different personal characteristics and professions use?
- Do the categories of the EUADers: (i) Inventors, (ii) Utilitarian Users, (iii) Work Enrichers and (iv) Opportunity Seekers really work in organisations. Are there any additional categories?
- What is the influence of different organisational cultures on the EUAD activity and how should the organisational culture and teams be constituted in order to support effective the EUAD?
- Are the applications developed by end-users really useful? What is the contribution of the EUAD in IS strategy? What is the performance of the EUAD and how could it be made better?

References

Aaltonen R. (1989), Naturalistinen paradigma evaluaatiotutkimuksessa, in Kriittinen ajattelu aikuiskoulutuksessa, Vapaan sivistystyön XXXI vuosikirja, Kirjastopalvelu, Pieksämäki, pp. 145-162

Abrahamsson P. (2001), Rethinking the Concept of Commitment in Software Process Improvement, Scandinavian Journal of Information Systems 13, pp. 69-98

Abrahamsson P. (1999), Commitment to Software Process Improvement - Development of Diagnostic Tool to Facilitate Improvement, in INSPIRE IV Training and Teaching for the Understanding of Software Quality, Fourth International Conference on Software Process Improvement Research, Education and Training, Hawkings C. et al (Ed.), British Computer Society, Great Britain, pp. 13-26

Agarwal R. and Prasad J. (1998), The Antecedents and Consequence of User Perceptions in Information Technology Adoption, Decision Support Systems, 22, pp. 15-17

Alavi M. and Weiss I.R. (1989), Managing the Risks Associated with End-User Computing, Journal of MIS, Vol 2, Number 3, Winter 85-86, in McLean E. R.(Ed.); Introduction to End-User Computing: Concepts, Issues, and Applications, John Wiley & Sons, New York, pp. 231-249

Alexandersson M. (1994), Metod och medvetande, Acta Universitatis Gothoburgensis, Göteborg

Andreu R. and Ciborra C. (1996), Organizational Learning and Core Capabilities Development: The Role of IT, Strategic Information Systems, No 5, pp. 111-127

Argyris C. (1991), Teaching Smart People - How to Learn, Harward Business Review 69, No 3, pp. 99-109

Ba S., Stallert J., and Whinston A. B. (2001), Research Commentary: Introducing a Third Dimension in Information Systems Design – The Case for Incentive Alignment, Information Systems Research Vol 12, No 3, pp. 225-239

Bandura A. (1986), Social Foundations of Thought and Action, Englewood Cliffs, New Jersey, Prentice-Hall

Barley S. R. (1996), Technicians in the Workplace: Ethnographic Evidence for Bringing Work into Organization Studies, Administrative Science Quarterly 41, pp. 404-441

Barney J. (1991), Firm Resources and Sustained Competitive Advantage, Journal of Management 17, No 1, pp. 99-120

Baskerville R. (1996), Deferring Generalizability: Four Classes of Generalization in Social Enquiry, Scandinavian Journal of Information Systems, Vol. 8, No 2, pp. 5-28

Benbasat I. and Zmud R. W. (1999), Empirical Research in Information Systems, MIS Quarterly 23, No 1

Benson D. H. (1989), A Field Study of End User Computing: Findings and Issues, In McLean E. R.; Introduction to End-User Computing: Concepts, Issues, and Applications, John Wiley & Sons, New York, pp. 41-54

Bharadwaj A.S., Sambamurthy V., and Zmud R.W. (1999), IT capabilities: Theoretical Perspectives and Empirical Operationalization, In De and DeGross (Eds.), Proc. of the twentieth ICIS, ACM, New York, pp. 378-385

Blili S., Raymond L., and Rivard S. (1998), Impact of Task Uncertainty, End-user Involvement, and Competence on the Success of End-user Computing, Information & Management 33, pp. 137-153

Bohn R.E. (1994), Measuring and Managing Technological Knowledge, Sloan Management Review 36, No 4, pp. 61-73

Boland R. J. (1995), Phenomenology: A Preferred Approach to Research on Information Systems, Reserch Methods in Information Systems, Mumford E., Hircheim R., Fitzgerald G., and Wood-Harper T. (eds.) (Elsevier Science Publications B. V., North Holland pp. 193-201

Boland R.J. and Tenkasi R.V. (1995), Perspective Making and Perspective Taking in Communities of Knowing, Organization Science Vol 6., No 4, July-August 1995, pp. 350-372

Boudreau M.-C., Gefen G., and Straub D. W. (2001), Validation in Information Systems Research: A State Of-The-Art Assessment, MIS Quarterly 25, No 1, pp. 1-16

Brancheau J. C. and Wetherbe J. C. (1990), The Adoption of Spreadsheet Software: Testing Innovation Diffusion Theory in the Context of End-User Computing, Information Systems Research Vol 1, No 2, June 1990, pp. 115-143

Brancheau J. C., Brown C. V. (1993), The Management of End-User Computing: Status and Direction, ACM Computing Surveys, Vol 25, No 4, December 1993, pp. 437-482

Brooking A. and Motta E. (1996), A Taxonomy of Intellectual Capital and a Methodology for Auditing It, 17th Annual National Business Conference, McMaster University, Hamilton, Ontario, Canada, January 1996, pp. 24-26

Brown R.B. (1996), Organisational Commitment: Clarifying the Concept and Simplifying the Existing Construct Typology, Journal of Vocational Behaviour, 49, pp. 230-251

Brown S. I. and Duguid P. (1991), Organisational Learning and Communities of Practice: Toward a Unified View of Working, Learning, and Innovating: Organization Science, Vol 2, No 1, February 1991, pp. 40-57

Brown S. I. and Duguid P. (2001), Knowledge and Organisation: A Social Practice Perspective, Organization Science, Vol 12, No 2, March-April 2001, pp. 198-213

Buchanan D. A. (1979), The Development of Job Design Theories and Techniques, Saxon House, Westmead, Farnborough, Hants., England

Burrell G. and Morgan G. (1979), Sociological Paradigms and Organisational Analysis, London, UK, Heinmann

Buttler T. (1998), Towards a Hermeneutic Method for Interpretive Research in Information System, Journal of Information Technology, No 13, pp. 285-300

Cale E. G. Jr. (1994), Quality Issues for End-User Developed Software, Journal of Systems Management, January 1994

Castells M. (2000), Materials for an Explanatory Theory of the Network Society, British Journal of Sociology, Vol 51, No 1, January/March 2000, pp. 5-24

Centers R. and Bugental D. E. (1966), Intrinsic and Extrinsic Job Motivations Among Different Segments of the Working Population, Journal of Applied Psychology, Vol 50, No 3, pp. 193-20

Chen L-d., Frolick M.N., Mao E., and Soliman S. (2000), Measuring user satisfaction with data warehouses: an exploratory study, Information & Management, APR, Vol 37, No 3, pp. 103-110

Chua W. Fong (1986), Radical Developments in Accounting Thought, The Accounting Review, 61, pp. 601-632

Compeau D. R. and Higgins C. A. (1991), A Social Cognitive Theory Perspective On Individual Reactions To Computing Technology, In Proceedings Of The Twelfth International Conference On Information Systems, ACM, New York, Dec 16-18, pp. 187-197

Compeau D. R. and Higgins C. A. (1995), Computer Self-Efficacy: Development of a Measure and Initial Test, MIS Quarterly, Vol 19, No 2, June 1995, pp. 189-211

Compeau D. R., Higgins C. A., Huff S. (1999), Social Cognitive Theory and Individual Reactions To Computing Technology: A Longitudinal Study, MIS Quarterly Vol 23 No 2, June 1999, pp. 145-158

Conner K. R. and Prahalad C. K. (1996), A Resource-based theory of the Firm: Knowledge Versus Opportunism, Organization Science, Vol 7, No 5, September-October 1996, pp. 477-501

Cook S. D. N. and Brown J. S. (1999), Bridging Epistemologies: The Generative Dance Between Organisational Knowledge and Organisational Knowing, Organisational Science, Vol 10, No 4, July-August 1999, pp. 381-400

Crossan M. M., Lane H. W., and White R. (1999), An Organisational Learning Framework: From Intuition to Institution, Academy of Management Review, Vol 24, No 3, pp. 522-537

Cunningham J. B. (1997), Case Study Principles for Different Types of Cases, Quality & Quantity 31, pp. 401-423

Curley K. F. and Pyburn P. J. (1982), Intellectual Technologies: The Key to Improving White-collar Productivity, Sloan Management Review, Fall 1982, pp. 31-39

Damsgaard J. and R. Scheepers (1999), A stage model of intranet technology implementation and management, In Pries-Heje, Ciborra, Kautz, Valor, Christiaanse, Avison and Heje (Eds.), Proceedings of the 7th European Conference on Information Systems, Copenhagen Business School, Copenhagen, Denmark 23-25, June 1999, pp. 100-116

Davis D. F., Bagozzi P. R., and Warshaw R. P. (1989), User Acceptance of Computer Technology: A Comparison of Two Theoretical Models, Management Science, Vol 35, No 8, pp 982-1000

Davis D. F., Bagozzi P. R., and Warshaw R. P. (1992), Extrinsic and Intrinsic Motivations to Use Computers in the Workplace, Journal of Applied Social Psychology, Vol 22, pp. 11-32

Davis F. D. (1986), A Technology Acceptance Model For Empirically Testing New End-user Information Systems Theory and Results, Doctoral Dissertation, Sloan School of Management, Massachusetts Institute of Technology

Davis G. B. (1989), Caution: User-Developed Systems Can Be Dangerous To Your Organization, In McLean E. R. (Ed.); Introduction to End-User Computing: Concepts, Issues, and Applications, John Wiley & Sons, New York, pp. 209-228

Deci E. (1975), Intrinsic Motivation, Plenum Press, New York

Doolin B. (1998), Information Technology as Disciplinary Technology: Being Critical in Interpretive Research on Information Systems, Journal of Information Technology, No 13, pp. 301-311

Drucker P. F. (1999), Knowledge-Worker Productivity: The Biggest Challenge, California Management Review, Vol 41, No 2, Winter 1999, pp. 79-94

Duê R. T. (1992), The Dangers of Downsizing, Information Systems Management, Summer 1992, pp. 65-67

Engeström Y. (1987), Learning by Expanding: An Activity-theoretical Approach to Developmental Research, Helsinki: Orienta-Konsultit

Engeström Y. (1990), Learning, Working and Imagining: twelve studies in activity theory, Helsinki: Orienta-Konsultit

Engeström Y. (1994), Training for Change: New Approach to Interaction and Learning in Working Life, International Labour Office, Genova

Fishbein M. and Aijzen L. (1975), Belief, Attitude, Intention and Behaviour, An Introduction to Theory and Research, Addison-Wesley, Reading

Flensburg P. (1986), Personlig databehandling, induktion, konsekvenser, möjligheter, Studentliteratur, Lund

Flood L. R. (1996), Holism and the Social Action of 'Problem Solving', Centre for Systems Studies, University of Hull, Manuscript, 30 p

Forsman L. (1998), Re-Engineering End-user Support in Distributed Organisational Computing, Moving from a Reactive to a Proactive Mode of Operation, Academic Dissertation, Acta Universitatis Tamperesis 640, Department of Computer Science, Finland, Vammalan Kirjapaino

Foss N. J. (1996), Knowledge-based Approaches to the Theory of the Firm: Some Critical Comments, Organization Science, Vol 7, No 5, September-October 1996, pp. 470-476

Gill T. G. (1996) Expert Systems Usage: Task Change and Intrinsic Motivation, MIS Quarterly, September 1996, pp. 301-323

Goldkuhl G. and Lyytinen K. (1982), A Language Action View of Information Systems, In Proceedings of the Third Conference on Information Systems, Ann Arbar, Michican, (Ross C and Ginzberg M Eds), pp. 13-30

Gummesson E. (1991), Qualitative Methods in Management Research, Newbury Park, Sage Publications, London, UK

Hackathorn R. D. (1987), End-user Computing by Top Executives, Data Base, Vol 19, No 1, Fall/Winter 1887, pp. 1-9

Hargadon A. and Sutton R. I. (1997), Technology Brokering and Innovation in a Product Development Firm, Administration Science Quarterly Vol 42, No 4, Dec 1997 p 716-749,

Harrison A. W. and Rainer R. K. Jr (1992), The Influence of Individual Differences on Skill in End-User Computing, Journal of MIS, Summer 1992, Vol 9, No 1, pp. 93-111

Hassinen K. (1988), Kokeellinen tutkimus aloittelijoiden tekemistä virheistä taulukkolaskentasovellusten käytöstä, Joensuun yliopisto, Matemaattis-luonnontieteellisen tiedekunnan raporttisarja

Heikkilä J. (1990), Managing End-User Computing, HKKK:n julkaisuja, B-98, Helsinki

Heikkilä J. (1995), The Diffusion of a Learning-intensive Technology into Organisations, The Case of Personal Computing, Helsinki School of Economics and Business Administration Ser A-104

Heng M. S. H., Trauth Eileen M., and Fischer Sven J. (1999), Organisational Champions of IT Innovation, Accounting, Management and Information Technologies 9, pp. 193-222

Herzberg F. (1966), Work and Nature of Man, Stapless Press

Herzberg F., Mausner B., and Snyderman B. B. (1959), The Motivation to Work, John Wiley, New York

Higgs P. (1995), Metatheories in Philosophy of Education: Introductory Overview, In Higgs (Ed.) Metatheories in Philosophy of Education, Heinemann, Johannesburg, pp. 3-17

Hilgard E. R. and Bower G. H. (1975), Theories of Learning, Prentice-Hall, New Jersey (fourth edition)

Hirschheim R., Klein H. K., and Lyytinen K. (1995), Information Systems Development and Data Modelling, Conceptual and Philosophical Foundations, Cambridge University Press, Cambridge, UK

Igbaria M. and Iivari J. (1995), The Effects of Self-Efficacy on Computer Usage, Omega, International Journal of Management Sciences, Vol 23, No 6, pp. 587-605

Igbaria M., Iivari J., and Maragahh H. (1995), Why do Individuals Use Computer Technology? A Finnish Case Study, Information & Management 29, pp. 127-238

Iivari J. (1991), A Paradigmatic Analysis of Contemporary Schools of IS Development, European Journal of Information Systems, Vol 1, No 4, pp. 249-272

Iivari J. and Maansaari J. (1997), The Impact of CASE on IS Professionals Work and Motivation to Use CASE, University of Oulu, Department of Information Processing Science, Oulu, Manuscript

Iivari J., Hirschheim R., and Klein H. K. (1998), A Paradigmatic Analysis Contrasting Information Systems Development Approaches and Methodologies, Information Systems Research, Vol 9, No 2, June 1998, pp. 164-193

Järvenpää S. L. and Stoddard D.B. (1998), Business Process Redesign: Radical and Evolutionary Change, Journal of Business Research 41, No 1, pp.15-27

Järvinen A. and Poikela E. (2001), Modelling Reflective and Contextual Learning at Work, 2nd International Conference on Researching Work and Learning, Galgary July 26-28

Järvinen P. (1999), Oman työn analyysi, Opinpaja Oy, Tampere

Katzell R. A., Barrett R. S., and Parker T. C. (1961), Job Satisfaction, Job Performance and Situational Characteristics, Journal of Applied Psychology. Vol 45, No 2, pp. 65-72

Kerola P. ja Järvinen P. (1975), Systemointi II, Gaudeamus, Helsinki. (cf. Järvinen P. and Kerola P., Notes on Research in Systemeering, In studies in Honor of Olavi Bertel Hellman on the Occasion of his Fiftieth Birthday, Annales Universitatis Turkuensis A 175, 67-73, 1978)

Kettelhut M. C. (1991), Don't let Users Develop Applications Without Systems Analysis, Journal of Systems Management, July 1991, pp. 23-26

Kirsch L. J. (1997), Portfolios of Control Modes and IS Project Management, Information Systems Research, Vol 8, No 3, September 1997, pp. 215-239

Klein H. K. and Myers M. D. (1999), A Set of Principles for Conducting and Evaluating Interpretative Field Studies in Information Systems, MIS Quarterly, 23, No 1, pp. 67-94

Kogut B. and Zander U. (1996), What Firms Do? Co-ordination, Identity, and Learning, Organization Science, Vol 7, No 5, September-October 1996, pp. 503-518

Kolb D. (1984), Experiential Learning, Experience as the Source of Learning and Development, Englewood Cliffs, NJ. Prentice-Hall

Kolb D. (1985), Learning-Style Inventory, McBer and Company, Boston, Massachusetts, USA

Kvale S. (1983), The Qualitative Research Interview, A Phenomenological and Hermeneutic Mode of Understanding, Vol 14, No 2, pp. 171-196

Kvale S. (1987), Validity in the Qualitative Research Interview, Methods: A Journal for Human Science Vol. 1 No. 2 (Winter), pp. 37-72

Kvale S. (1989), To Validate is to Question, In S. Kvale (ed.) Issues of validity in Qualitative Reasearch, Lund, Studentliteratur, pp. 73-92

Lassila K.S. and Branceau J.C. (1999), Adoption and Utilization of Commercial Software Packages: Exploring Utilization Equilibrium, Transitions, Triggers, and Tracks, Journal of Management Information Systems, Fall 1999, pp. 63-90

Leino T. (2001), Itsenäiskäytön johtaminen tietohallinnon osa-alueena (Management of End-user Computing as a Sub-function of Information Resources Management), Academic Dissertation, Publications of the Turku School of Economics and Business Administration, Series A-9:2001, Finland, Kirjapaino Grafia Oy, Turku

Levitin A. V. and Redman Thomas C. (1998), Data as a Resource: Properties, Implications, and Prescriptions, Sloan Management Review, Vol 40, No 1, Fall 1998, pp. 89-101

Lyytinen K. (1986), The Information Systems Development as Social Action: Framework and Critical Implications, Jyväskylä Studies in Computer Science, Economics and Statistics 8, Academic Dissertation, Jyväskylä

Lyytinen K. and Klein H. (1985), The Critical Social Theory of Jürgen Habermas (CST) as a Basis for Theory of Information Systems, Mumford, E., Hircheim, R., Fitzgerald G., and Wood-Harper T. (Eds.) Research Methods in Information Systems, North Holland, Amsterdam, pp. 219-232

Mäkelä K. (1990), Kavalitatiivisen analyysin arviointiperusteet, In "Kavalitatiivisen aineiston analyysi ja tulkinta" pp. 42-61, Gaudeamus, Helsinki, Finland

Malhotra Y. (1997), "Knowledge Management in Inquiring Organisations" in Proceedings of 3rd Americas Conference on Information Systems, Indianapolis, IN, August 15-17, pp. 293-295

Marakas G. M., Yi Y. M., and Johnson R. D. (1998), The Multilevel and Multifaceted Character of Computer Self-Efficacy: Toward Clarification of the Construct and an Integrative Framework for Research, Information Systems Research, Vol 9, No 2, June 1998, pp. 126-162

Markus M. L. and Benjamin R. I. (1996), Change Agentry - the Next IS Frontier, MIS Quarterly, Vol 20, No 4, Dec 1996, pp. 385-407

Markus M. L. and Benjamin R. I. (1997), The Magic Bullet Theory in IT-enabled Transformation, Sloan Management Review Vol 38, No 2, pp. 55-68, Dec 1997

Maslow, A. H. (1943), A Theory of Human Motivation, Psychological Review, Vol 50, No 4, pp. 370-396

McDermott R. (1999), Why Information Technology Inspired But Cannot Deliver Knowledge Management, California Management Review, Vol 41, No 4, Summer 1999, pp. 103-117

McLean E. R. (1979), End-Users as Application Developers, MIS Quarterly, Vol 3, No 4, Dec 1979, pp. 37-46

McLean E. R. (1989), Introduction to End-User Computing: Concepts, Issues, and Applications; John Wiley & Sons, New York

McLean E. R. and Kappelman L. A. (1993), The Convergence of Organisational and End-user Computing, The Journal of Management Information Systems, Winter 1992-93, Vol 9, No 3, pp. 145-155

McLean E. R., Kappelman L. A., and Thompson J. P. (1993), Converging End-user and Corporate Computing, Communications of the ACM, Vol 36, No 12 , pp. 79-92, December 1993

Miles M. B. and A. Huberman M. (1994), Qualitative Data Analysis: An Expanded Sourcebook of New Methods, SAGE Publications, London

Morgan G. (1980), Paradigms, Metaphors, and Puzzle Solving in Organization Theory, Administrative Science Quarterly 25, pp. 605-622

Munro M. C., Huff S. L., Marcolin B. L., and Compeau D. R. (1997), Understanding and Measuring User Competence, Information & Management 33, pp. 45-57

Nahapiet J. and Ghoshal S. (1998), Social Capital, Intellectual Capital, and the Organizational Advance, Academy of management Review, Vol 23 No 2. 242-266

Newman M., Boland, Jr. (1966), Hermeneutics, Exegesis and Organisational Texts: Maintaining an Openness of Inquiry in Interpretation, September 1996, Manuscript

Nonaka I. (1994), A Dynamic Theory of Organisational Knowledge Creation, Organisation Science Vol 5, No 2, pp. 14-37

Nonaka I. and H. Takeuchi (1995), The knowledge-creating company - how Japanese companies create the dynamics of innovation, Oxford University Press, Oxford

Nonaka I., R., Toyama, and Konno N. (2000), SECI, Ba and leadership: a unified model of dynamic knowledge creation, Long Range Planning 33, pp. 5-34

Nurminen M. I. (1997), Paradigms for Sale: Information Systems in the Process of Radical Change, Scandinavian Journal of Information Systems, Vol 9, No 1, pp. 25-42

Oldham G. R. and Cummings A. (1996), Employee Creativity: Personal and Contextual Factors at Work, Academy of Management Journal, Vol 39, No 3, pp. 607-634

Orlikowski J. W. and Baroudi J. J. (1991), Studying Information Technology in Organizations: Research Approaches and Assumptions, Information Systems Research Vol 2 No 1, March 1991, pp. 1-28

Orlikowski W.J. (1992), Learning from Notes Organizational Issues in Groupware Implementation, In Proceedings of CSCW'92, ACM, New York, pp. 362-369

Orlikowski W.J. (2000), Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations, Organization Science 11, No 4, pp. 404-428

Pare G. and Elam J. J. (1995), Discretionary Use of Personal Computers by Knowledge Workers: Testing of Social Psychology Theoretical Model, Behaviour & Information Technology, Vol 14, No 4, pp. 215-228

Patton M. Q. (1990), Qualitative Evaluation and Research Methods. (2nd edition), London, Sage

Pliskin N. and Shoval P. (1997), End-User Prototyping: Sophisticated Users Supporting System Development, Vol 18, No 4, Data Base, Summer 1987, pp. 7-17

Porras J.I. and Hoffner S.J. (1986), Common Behavioural Changes in Successful Organisation Development Efforts, Journal of Applied Behavioural Science 22, pp. 477-494

Rantapuska T., Siakas K., Sadler C., and Walaa M. (1999), Quality Issues of End-User Application Development, In "Training and Teaching for the Understanding of Software Quality", Fourth Int. Conf. On Software Process Improvement Research, INSPIRE IV, C Hawkins, E Geaorgiadou, L Perivolaropoulos, M Ross and G Staples (Eds.), The British Computer Society, Great Britain

Rantapuska T. (2000), The End Users as Innovators in Learning Organisations, Licentiate Thesis, University of Tampere, Tampere

Rivard S. and Huff S. L. (1985), An Empirical Study of Users as Application Developers, Information & Management 8, pp. 89-102

Rockart J. F., Flannery L. S. (1989), The Management of End-User Computing, Communications of Association for Computing Machinery, Inc, 1983, In McLean E. R.; Introduction to End-User Computing: Concepts, Issues, and Applications, John Wiley & Sons, New York, pp. 249-270

Rogers E. M. (1995), Diffusion of Innovations, The Free Press, New York, 4th Edition

Ryan R. M. and Deci E. L. (2000), Intrinsic and Extrinsic Motivations: Classic Definition and New Directions, Contemporary Educational Psychology 25: pp. 54-60

Salansik G. R. (1982), Commitment is too easy!, Tushman M. and Moore W. (Ed.) Readings in the Management of Innovation, Boston: Pitman, pp. 207-222

Sandberg J. (2000), Understanding Human Competence at Work: An Interpretative Approach, Academy of Management Journal, Vol 43, No 1, pp. 9-25

Sandelowski M. (1995), Qualitative Analysis: What It Is and How to begin, Research in Nursing & Health, Vol 18, pp. 371-375

Schiffman S. J., Meile L. C., Igbaria M. (1992), An Examination of End-user Types Information & Management, Vol 22, pp. 207-215

Senge P.M. (1990a), The Fifth Discipline: The Art and Practice of the Learning Organization, New York, NY, Doubleday

Senge, P.M. (1990b) "The Leader's New Work: Building Learning Organisations", Sloan Management Review, 32 (1), Fall 1990, pp. 7-23

Siemon E. and Wu Y. (2000), A Comparison of two Visual Programming Techniques for End Users

Soh C. and Markus M.L. (1995), How IT Creates Business Value: A Process Theory Synthesis, In DeGross, Ariav, Beath, Hoyer and Kemerer (Eds.), Proc. of 16th ICIS Conference, Amsterdam Dec 10-13, 95, ACM, New York, pp. 29-41

Stake E. R. (1995), The Art of Case Study Research, SAGE Publications, London

Stephens L. (1962), A Case for Job Enlargement, New Society, Vol 1 No 2., pp. 9-11

Straub D., Limayem M., and Karahanna-Evaristo E. (1995), Measuring System Usage: Implications for IS Theory Testing, Management Science, Vol 41, No 8, August 1995, pp. 1328-1342,

Strauss A. and Corbin J. (1990), Basics of Qualitative Research: Grounded Theory Procedures and Techniques, SAGE Publications, Inc. Newbury Park, California

Sumner M. and Klepper R. (1987), Information Systems Strategy and End-User Application Development, Data Base, Vol 18, No 4, Summer 1987, pp. 19-30

Thompson T. S. H., Lim V. K. G., and Lai T. Y. C. (1999), Intrinsic and Extrinsic motivation in Internet Usage, Omega, No 27, pp. 25-37

Torvalds L. and Diamond D. (2001), Just for Fun, (Original English version, Just for Fun, Harper Collins 2001), Schildts Kustannus Oy, Keuruu 2001, ISBN 951-50-1203-1

Truex D. P., Baskerville R., and Klein H. (1999), Growing Systems in Emergent Organisations, Communications of the ACM, Vol 42 No 8, August 1999, pp. 117-123

Turner A. N. and Lawrence P. R. (1962), Industrial Jobs and the Worker: an Investigation of Response to Task Attributes, Harvard University Division of Research, Graduate School of Business Administration, Boston

Venkatesh V. (1999), Creation of Favourable User Perceptions: Exploring the Role of Intrinsic Motivation, MIS Quarterly, June 1999, pp. 239-260

Venkatraman N. and Henderson J. C. (1998), Real Strategies for Virtual Organizing, Sloan Management Review 40, No 1, Vol 40, Fall 1998, pp. 33-48

Vijayaraman B. S. (1998), An Empirical Study of End User Computing Support in Large Organisations, Georgia State University, College of Business Administration, London

Virolainen K. and Kerola P. (1990), Omaksumistyylien kartoitus, Learning-Style Inv Oulun Yliopisto/Tietojenkäsittelyopin laitos

Viteles M.S. (1950), Man and Machine Relationship, the Problem of Boredom, in R. B. Ross (Ed.), Proceedings of the Annual Fall Conference of the Society for Advancement of Management, New York, pp. 129-145

Walsh J.P. and Ungson G.R. (1991), Organizational memory, Academy of Management Review 16, No 1, pp. 57-91

Walsham G. (1995), The Emergence of Interpretativism in IS Research, Information System Research 6, No 4, Dec 1995, pp. 376-394

Wand Y. and Wang R.Y. (1996), Anchoring Data Quality Dimensions In Ontological Foundations, Comm. ACM 39, No 11, pp. 86-95

Weick K.E. (1990), "Cognitive Processes in Organisations," in L.L. Cummings and B.M. Staw (Ed.), Information and Cognition in Organisations, Greenwich, CT: JAI Press

Welke R. J. (1994), The Shifting Software Development Paradigm, Data Base, Vol 25, No 4, November 1994, pp. 9-16

Wittgenstein L. (1972), Lectures and Conversations on Aesthetics, Physiology and Religious Belief, Barrett, C. (Ed.), University of California Press, Berkeley, CA

Yin R. (1984), Case Study Research, Design and Methods, Sage Publications, London

Zuboff S. (1988), In the Age of Smart Machine: The Future of Work and Power, Basic Books, New York