Using Information and Communication Technology

Petra Fisser

2001

Ph.D. thesis
University of Twente

Twente University **Press**

Also available in print:
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Twente University Press,
P.O. Box 217, 7500 AE Enschede, The Netherlands, www.tup.utwente.nl

Cover design Jo Molenaar, [deel 4] ontwerpers, Enschede
Print Grafisch Centrum Twente, Enschede

ISBN 903651679x

USING INFORMATION AND COMMUNICATION TECHNOLOGY
A PROCESS OF CHANGE IN HIGHER EDUCATION

PROEFSCHRIFT

ter verkrijging van
de graad van doctor aan de Universiteit Twente,
op gezag van de rector magnificus,
prof.dr. F.A. van Vught,
volgens besluit van het College voor Promoties
in het openbaar te verdedigen
op vrijdag 12 oktober te 13.15 uur

door

Petra Hermina Gerretje Fisser
geboren op 20 maart 1973
te Amsterdam

Dit proefschrift is goedgekeurd door de promotoren

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Preface and acknowledgements

During my studies at the Faculty of Educational Science and Technology at the University of Twente I discovered the Internet and its relevance for education. The growing possibilities and the impact of the technology to support the learning and teaching processes were enormous and fascinated me. Therefore after finishing my studies I did not hesitate to start a new study in this area: research about using information and communication technology and the consequent change process in higher education. This research was initiated by both the Faculty of Educational Science and Technology and the Center for Higher Education Policy Studies, by Jef Moonen, Frans van Vught and Peter Maassen. I would like to thank them for giving me the opportunity to carry out this multidisciplinary research.

I started my research activities at the Centre for Telematics and Information Technology. Ignas Niemegeers offered me the possibility to work at this research institute, where I participated in national and international projects. The second and third year of my research I have worked at the DINKEL Institute / Educational Centre. I would like to thank Kees Ruijter and Michiel van Geloven for the opportunity to work there as a researcher, an educational consultant and a policy advisor. Those years were very valuable for me and kept me with both feet on the ground. A special thank you for Cees Terlouw who has been stimulating me in my research activities during the time at the DINKEL Institute, and a thank you for Ellen Peters, I have enjoyed working with you and appreciated your support during the statistical analyses very much. A very special thank you to Lisa, thank you for being my friend, your friendship means a lot to me.

As part of my research five case studies were carried out. I thank all respondents for their time and input. Rachelle Heller, Georges Van der Perre, Hans Naslund and Anna-Kaarina Kairamo, thank you for inviting me at your university and organising a very interesting programme for me.

During the four years of research I was fortunate to have a supportive advisory committee with Peter Maassen, Jules Pieters, Ignas Niemegeers, Leo Goedegebuure and Georges Van der Perre. I would like to thank you for all your support and contributions.

Working together with Jef Moonen, Betty Collis and Marijk van der Wende as promotors was wonderful. Marijk, thank you for your interest and stimulating discussions, I have appreciated that very much. Jef, thank you so much for believing in me and keeping me on track. I have really enjoyed working with you and you have made a great impact on both my research and myself. Betty, your enthusiasm, support and innovative ideas have no limits. You have stimulated me to think beyond myself and my research focus and you have given me the opportunity to grow and explore. Thank you!

A special thank you to some of my colleagues and friends. Carin, Allard, Wim, Koos, Gerard, Rik, Ria and Karen, thank you for your support and for the wonderful time in Enschede.

I owe my family many thanks for supporting and stimulating me. Mama, PaPa, Andrea, Cor, Corrie and Jelle thank you! Ferry, thank you for everything, for being there for me, believing in me and supporting me without a doubt.

Petra Fisser
Enschede, October 2001

1 Using information and communication technology: A process of change in higher education

The title of this dissertation "Using Information and Communication Technology, a process of change in education" relates to questions that are currently being asked at many post-secondary educational organisations. The inevitable expansion of the opportunities of technology and the growing awareness of the possibilities for using the technology in specific delivery and pedagogical models are causing many universities and other institutions to increase the use of information and communication technology (ICT) in education, particularly network technology or 'Web-based systems'. Embedding the technology, especially network-based, in education results in new ways and new forms of learning. Together these new learning and delivery approaches that make use of networked computer systems are being called 'ICT in education'. Other terms are also being used to indicate the application of technologies to support the educational process, such as e-learning and Internet-based distance learning. In general, all terms are related to forms of learning that rely on tools and systems that make use of Web-based technology.

Implementing and integrating a new form of ICT in education is the subject of this dissertation. In this research the context in which ICT is used will be focused on higher education, and on universities in Europe in particular. An introduction to reasons for universities to steer their involvement in the development around ICT in education is described in Section 1.1 and the assumption that adopting some new form(s) of ICT in education can be seen as a change process is introduced in Section 1.2. The overall research question and the theoretical framework that will be applied (and further developed) in this research project will be presented in Section 1.3. The theoretical framework helps to position the overall research question and to identify theories valuable for the background of the research. In Section 1.4 an overview will be given of the content of the subsequent chapters.

1.1 Universities in a changing environment

An organisation is not an entity on its own, it has to interact with its environment. As universities are organisations, this applies to them as well. According to Dill (1996) in the American context the changes most important to the university occur external to it. Evidence for this in the Western European context can also be found (see for instance Neave & Van Vught, 1991). The environment in which universities have to operate has changed significantly in the last few decades and is still changing. Universities have to react to these changes. Sometimes they may want to anticipate changes and adapt in advance of crises. The internal characteristics of the university play a significant role in the way they react. To indicate which changes have occurred in the environment of the university during the last years an overview is given in Sections 1.1.1-1.1.7 of some of the most substantial developments affecting higher education.

1.1.1 Government and policy

Government and policy developments are important external influences not only on society in general but also on the requirements that universities face. The influence of Western European governments on higher education has been quite important since the 19th century, but has been decreasing over the last decades (Neave, 1988; Neave & Van Vught, 1991). The trend towards deregulation and consequently more autonomy for a university is one of the results. In this respect Olsen (1988) identified four steering models that can explain the relation between state authorities and higher education organisations. Olsen's models combine the different views of the roles of the state, societal actors and government agencies and the models provide possible answers to the question why and under what condition governments should want to give universities autonomy. The four models are discussed here briefly:

- *The sovereign, rationality-bounded steering model*
  In this model higher education is seen as a governmental instrument for reaching political economic or social goals. This role of the university is determined by strong control over universities and colleges with a strong emphasis on them being accountable to political authorities. Decision-making in such a model is centralised and top down and steering takes place by hierarchy. In this model higher education organisations change because politics change.

- *The institutional steering model*
  In this model higher education organisations have the responsibility to protect academic values and traditions against the impulses from political pressures. Protecting academic freedom and traditions and storing and transmitting knowledge are the major roles of a university. Decision-making in this model is not directly influenced by government, government and universities even share the assumption that higher education needs to be protected against market forces and political interests.

- *The corporate-pluralist steering model*
  In this model government is seen as one of the many actors that have power and control and that there are many competing actors with respect to higher education. Government is just one of the stakeholders. Other stakeholders are for example students unions, industry and professional associations. Decision-making at universities is a process of participation of different interest groups and the dominant mode of decision-making is negotiation and consultation. Change of higher education organisations in this model depends on power, interests and alliances.

- *The supermarket steering model*
  In this model the role of government is minimal. It assumes that it is more efficient, effective and just when private individuals engage in activities (through the market) with the higher education organisations than when practically all activities are coming from government. The role of the universities is to deliver services: teaching and research. The role of the government is one of assuring that the market mechanisms in higher education run smoothly. There is no dominant arena of policy making, as a result of an extreme decentralisation. The autonomy of universities (and colleges) depends on their ability to survive. Therefore, changes in the higher education organisations depend on the relative amount of stability or change in the environment.

> Even though this model has some overlap with the corporate-pluralist steering model with regard to the involvement of different stakeholders, there is an important contrast. In the corporate-pluralist steering model the stakeholders have their stake because their role is legitimised (and often institutionalised), whereas the stakeholders in this supermarket model earn their positions because of the resources they have available (Olsen, 1988).

According to Gornitzka and Maassen (2000) in most Western European countries a move towards the supermarket steering model can be observed. In their research Gornitzka and Maassen have seen a trend toward a less dominant role of government (except in England) and typify this trend as a combination of market and state. There are differences within this trend in the different countries, especially related to the focus of the relation (such as quality assurance and financial contracts). Gornitzka and Maassen also state that even though there is a trend towards the supermarket model, this model will not be found in its pure form, because of the differences between the countries. But in general it can be said that the role of the government is decreasing and in many cases with it the level of public funding per capita. Consequently universities will more and more aim at delivering services to the market and thus respond more directly to demographic changes and market forces.

1.1.2 Demographic changes

Looking at demographic changes from a broadly strategic perspective Neave and Van Vught (1991) claim that the current demographic profile implies a shift in government expenditure into those areas associated with providing services, such as medical care and pensions in response to the growing number of senior citizens. This means that universities face budget cuts to meet the demands from the other service providers and that they are struggling to find solutions to these problems of increased financial load. Neave and Van Vught also claim that budget cuts and retrenchment operations in countries in Western Europe form a familiar litany. They explain that budget cuts are specific outcomes within the domain of higher education measures which themselves are the product of broader policy decisions taken at a strategic level elsewhere in the political-administrative nexus. As a consequence of this general trend towards demographic changes it can be seen that the world-wide demand for higher education is increasing. In developing and transition countries this increase is related to first general access to education (Williams, 1995), in the Western world the demand for lifelong learning is an important factor. Focussing on the Western world, the demand for lifelong learning results in a necessity for better and more differentiated access to education. The changing student profile is the product of the changing demographic profile of society. Kerr (2001) for instance describes the phenomenon that retired persons wanting further education as a whole new market . This shift has its impact on many aspects of society and has therefore also its influence on universities. Demographic changes have their influence on both the increasing demand for higher education and on the composition of the student population. The increasing numbers of part-timers, lifelong learners and other new groups of learners that are interested in higher education form in part also new market forces because of several reasons, including the diminishing public funding by the government, the increasing purchase power of lifelong learners and the competition on the educational market. This is described in the next section.

1.1.3 Market forces

As has been described in the previous sections in addition to influences from governments, universities are also being influenced by market forces and a diversity of stakeholders. An example of this is what Gibbons (1995) calls 'social accountability': the growing awareness about the variety of ways in which advances in science and technology can affect the public interest. This awareness leads to the conviction that higher education should be relevant to the labour market and to economic growth (Meek & Wood, 1998). According to Goedegebuure and De Boer (1996) there is also a trend towards increased accountability in terms of value for money. The efficiency of universities is an important issue all over the world, considering the limited public resources available for education. Furthermore, the university has lost its monopoly on higher education: new providers of education now compete with the traditional universities for students (Kerr, 2001). These trends imply that there are more and more stakeholders that are trying to influence universities and that universities sense a form of competition for a diversity of resources such as budget, students and research.

Williams (1995) identifies in his research that almost all member countries of the Organisation for Economic Co-operation and Development (OECD) claim to have experienced some increase during the past decade in their exposure to market forces. In the Western world the stagnating and diminishing numbers of regular students and an increase in number of students from new target groups are examples of forces coming from the market. As a consequence to the growing numbers of new kinds of students such as part-timers and lifelong learners, the university has to deal with the fact that the characteristics of their students are changing. More and more entry-level students are no longer the 18-year old secondary education cohorts who will come to the university, live on campus and pursue a specific degree. The students of the near future will be learners that are more mature and can relate their learning to professional and life experiences. This group of students is more experienced in learning and has to divide its time between learning and other activities as work, family and professional obligations. This immediately implies that these learners need a high level of flexibility of time, space, content, types of study materials and assignments. In relation to market forces these new learners form a special stakeholder group. They are the learners that 'shop' for education in the supermarket model as described in the previous section. Because of the diminishing monopoly of universities on knowledge and education universities have to compete for this group of learners (who have often substantial purchasing power) with other (public and private) educational providers. Another influence on the demand for education comes from pressures related to what is called the knowledge economy.

1.1.4 The knowledge economy

A number of factors affecting the 'inner life' of universities find their origins in beliefs, by now widely held, that our current society is rapidly changing into a so-called *knowledge economy* (Gibbons, et al., 1994). The key characteristic of the knowledge economy lies in the belief that wealth (or productivity) is increasingly dependent on the development and application of new knowledge by specialist knowledge workers and the nation's capability to apply this new knowledge is essential to economic development. Economies are increasingly being built on a foundation of information, learning and adaptation. Both the quantity of knowledge is increasing and the production of knowledge is accelerating (De Weert, 1999; Scott, 1997).

In relation to this Gibbons and his colleagues have identified globalisation (the intensification of international competition in business and industry) as the driving force behind a significantly increased supply of and demand for 'marketable knowledge'. Gibbons and his colleagues say that firms that wish to compete in the global economy will have to possess the organisational abilities (knowledge) that enables them to maintain or increase their competitive advantage in a turbulent market environment. For this goal education is needed to obtain the necessary knowledge. Training the employees of a company can be an important role of universities in responding to the demand for a knowledge economy.

For the education of present students, one of the implications of the knowledge-driven economy is that students will have to be prepared for a labour market in which the knowledge economy is a fact. This means that students should acquire appropriate skills for this context, and this will have to be reflected in the higher education curriculum, in its content, structure, length and mode of delivery (Gibbons et al., 1994).

It is expected that the emerging knowledge economy will offer enormous opportunities to universities. The opportunity for universities to strengthen their role as knowledge producers in the knowledge economy will have its impact on the way the university and its educational processes are organised.

1.1.5 Internationalisation of higher education

Internationalisation has become a widespread and strategically important phenomenon in higher education, including a broad range of activities, such as the mobility of students and scholars, the internationalisation of curricula, the cross-border delivery of education, the establishment of international university consortia, and a substantial export and import of higher education products and services (Kalvermark & Van der Wende, 1997). These developments were motivated by a number of trends, briefly described here.

First, international academic exchange and mobility have been stimulated by governments and specialised agencies for decades. In the case of Europe, the role of the European Union has been significant in establishing numerous cooperation and exchange agreements between universities in different European countries. Over the last years, the use of ICT in these forms of inter-university cooperation have been developed through projects focusing on open and distance learning. Second, established higher education providers in western countries perceive the growing demand for higher education in countries with an insufficient national higher education infrastructure as a potential market. Decreasing public (national) funding for higher education, motivated institutions in various countries to actively explore and address these markets. In many cases ICT is used to effectively reach out to distant students who are interested in earning a foreign degree while staying in their own country (Bjarnason et al, 2000; Van der Wende, 2001). Third, the international supply of educational services is driven by the liberalisation of educational markets through initiatives such as regional trade agreements and expected further actions of the World Trade Organisation (WTO). This has led to a growing international competition in higher education and an enhanced economic rational for internationalisation. The economic potential of this market has attracted new types of higher education providers, e.g. virtual universities, operating on a purely commercial basis, leading to again more competition.

These developments have led to a new situation, which is characterised by substantial cross-border activities and mobility in higher education, in which the use of ICT plays an increasing important role.

1.1.6 Lifelong learning

In each of the previous section something has been said in relation to lifelong learning. Lifelong learning, the recognition that learning may stretch out across a lifetime, is the new educational reality according to Field (2000). Universities as part of the changing world will have to play an essential role to meet the challenges of society by organising and promoting research and offering study programmes based on the link of research and teaching, they will have to educate and train young researchers and to offer and provide continuing academic education and training (lifelong learning) (Erichsen, 1998).
The notion that life is a process of continual learning has been an issue for several years now. With regard to this idea the term lifelong learning has emerged during the past decades. Lifelong learning will be of interest for persons who are no longer at school or university. Kaiser and De Weert (1994) argue that many variables are important in students' decisions to opt for higher education, including social background, personal interest, and the role of peers. In addition to this there is a strong economical motive: individuals weigh their current earnings against their gain in future income due to (additional) education. Massy (1996) adds that the growing demand for higher education stems from people's desires to improve their employment prospects and a conviction that obtaining more education will bring dividends in that regard. These topics resulted in efforts from governments and institutions to improve access to education. This is often called the 'massification' of higher education, an increased participation in higher education by students of all backgrounds, including non-traditional students such as students who also participate in the labour market.
In this perspective lifelong learning implicates that a person has the possibility to learn throughout his or her life, instead of restricting learning to the ages 4 to approximately 25. On the job training, vocational training, part-time learning, staff development, re-entry education, etc. all have a relation with lifelong learning. It is often assumed that the process of lifelong learning involves the use of some form of information and communication technology.

1.1.7 The role of information and communication technology

Information and communication technology (ICT), described as (network) technology or Web-based systems that can be used in education (see Section 3.1 for more details), is seen as a major response to the changes, trends and stakeholders as described in Sections 1.1.1-1.1.6. It is assumed that ICT makes it possible to reduce geographical distances in order to make them less of a barrier for both students and universities. The university that was once perceived as inaccessible is within easy reach when the possibilities of ICT are used. For this research it is interesting to see if ICT can be seen as creating opportunities, increasing the efficiency and flexibility of the learning process and of academic work.

In relation to lifelong learning for example, the university should think for instance about compensating (to a certain amount) for the home or working situation of the student. This could mean offering time- and place independent learning. Using new forms of ICT for lifelong learning could support this process and can be used for instance as a means for communication between lifelong learning students and the instructors. In this case using

new forms of ICT can also be seen as a necessary requirement for universities to prepare students for the competitive global marketplace (Dooley, 1999).

Many universities in the Western world are using different Web-based applications to respond to various needs of their learners. These Web-based systems are becoming priority investments within these universities and will result in major professional and cultural change for faculty, with respect to roles, teaching methods, work processes, avenues for recognition, and research opportunities. According to Collis (1996) the persons and resources accessible via the use of Web-based tools and resources in education may be beyond what the learner could have access to in his ordinary learning context, but they may be also the same persons and resources, made accessible in different ways and at different times than before. This has as result that students making use of a new form of ICT in education will have more choice and control over the timing, location and format of their learning agendas than is possible with traditional delivery methods. Much research has been done in ways of using Web-based systems. Recently a number of studies have compared the use of network technology or Web-based systems at a number of universities throughout Europe. The results of these studies show in general that much has been done, usually by individuals or small groups of individuals, and that the time has come to make an effort for more large-scale projects and partnerships between departments, faculties and other universities (see for instance Collis, & Wende, 1999; Van Geloven et al., 2000).

Even though only a few examples have been mentioned here, they are enough to show that there are external and internal pressures for the evolution of ICT in education and that universities are giving different emphases to different ways of using various forms of ICT. If a university wants to survive on the market it can be expected that it will try to adapt to demands from in- and outside the university. In other words, decisions made in the external environment of a university (for instance policy from government) can have an high impact on the university itself. An important issue to consider is how individual universities adapt to the developments being triggered by the evolution of ICT in education. ICT has enlarged the opportunities available for higher education organisations and is having an effect on the traditional modes of production, ways of communicating with students, organisational structures, budgeting and accountability mechanisms and quality assurance procedures. But how will the universities cope with this?

1.2 ICT in education, a change process

The increasing use of ICT in education can be seen as a major change, a change which most universities have been getting used to during the past years. This change is not something that just happens, it is a cycle of events that results in the actual change. Before describing the change process it is important to describe what is meant with ‘change’. This is done in the next section.

1.2.1 The meaning of change

Change can be understood as a step in time during which something of substantial importance to the operating procedures of an organisation has changed. This step in time can be a short or a longer period. Fullan (1991) describes two categories of changes, first- and second-order order changes. First-order changes are those changes that improve the efficiency and effectiveness of what is currently done, without disturbing the basic

organisational features, without substantially altering the way that actors perform their roles. Second-order changes seek to alter the fundamental ways in which organisations are put together, including new goals, structures and roles. Often the challenge is to establish second-order changes, but usually only the first-order changes are reached. In relation to second-order changes and the use of new forms of ICT in education Bates (2000) argues that if universities are successfully to adopt the use of new forms of ICT in education, much more than minor adjustments in current practice will be required. The effective use of technology requires a revolution in thinking about teaching and learning, part of that revolution necessitates restructuring universities - that is, changing the way higher education institutions are planned, managed and organised (Bates, 2000). Bates further states that history suggests that the introduction of new technology is usually accompanied by major changes in the organisation of work. The use of technology needs to be embedded within a wider strategy for teaching and learning. Furthermore, as the institution starts to use technology outside its local area, new administrative and academic procedures will be necessary in the areas of admissions, finance and academic policy (Bates, 2000).

It can be seen that change is related to a discrepancy between an old and a new situation and that it is related to something new or different. Reaching something new or establishing a difference can come about either because it is imposed or because the actors involved in the change voluntarily participate (or even initiate) in the change. Relating to changes in an educational context, it can be said that this involves a change in practice. This can be accomplished by a change in materials, a change in teaching approaches and a change in beliefs (Fullan, 1991). All three are needed in an overall change process, but as can be expected a change in materials is easier than a change in beliefs. To accomplish all levels of change, time and effort is needed to go through a change process.

1.2.2 The change process

Based on what Fullan (1991) described in relation to the change process that involves the stages initiation, implementation and institutionalisation, Collis and Moonen (2001) outline the ideal life cycle of a process of change in education directly related to using a new form of ICT in education. This cycle includes the following steps:

- *Pre-initiation and initiation*. In this stage specific experiences with ICT in education are identified in the faculties and departments of the university. Based on these (bottom-up) experiences decision-makers in the department, faculty or university choose to implement the use of new forms of ICT on a broader level and produce a strategic plan. An implementation leader and a team are assembled, the appropriate technology provision is determined and an implementation methodology is developed.
- *Implementation*. In this stage the implementation of the decisions made in the strategic plan are carried out. A formative evaluation of the process and the actual implementation results in fine-tuning of the methodology and the implementation plan.
- *Institutionalisation*. In this stage the change becomes institutionalised and becomes an integral part of the ordinary operating procedures of the department, faculty or university (Collis & Moonen 2001).

It can be expected that this process from initiation to institutionalisation with regard to ICT in education will be a five-year process (Plomp, 1992). This dissertation focuses on factors that cause universities to think about different approaches in the processes of initiation,

implementation and institutionalisation with new initiatives relating to information and communication technologies or, more specifically, to commit themselves to supporting some new form of ICT in education and the implications of this for the university. In this process different actors at universities are involved. In relation to the internationalisation of universities Van der Wende (1996) identified three different actors that are of major importance in a change process: (a) an innovator, (b) a broader group of faculty staff and (c) policy officers and the top management at the central level of the university. From what has been said in the previous sections it is argued that these actors also play a major role in the change process in a university with regard to new forms of ICT in education. Yetton (1997) suggests three possible approaches in relation to supporting a new form of ICT in education in which several actors have specific roles:

- The integrated approach, with a central unit managing the implementation of teaching and learning with ICT as well as other staff-development programmes;
- The parallel approach, creating an ICT-based teaching and learning unit that operates separately and in parallel with the existing staff-development unit(s);
- The distributed approach, which is bottom-up and devolves responsibility for ICT-based teaching and learning developments to local innovators across a range of faculties and units (Yetton, 1997).

In relation to this Mooij and Smeets (2001) identified five successive phases of ICT implementation. These phases relate to secondary schools, but are applicable to a university context:

- Incidental and isolated use of ICT by one or more instructors;
- Increasing awareness of ICT relevance for education, at all levels;
- Emphasis on ICT coordination and hardware;
- Emphasis on didactic innovation and ICT support;
- Use of ICT-integrated teaching and learning, independent of time and place.

1.2.3 ICT as a change process

From these examples of stages in an implementation process related to ICT in education it can be argued that universities will have specific reasons for adopting a specific institutional approach to new forms of ICT in education and that the implementation of ICT in education can be seen as a change process. For universities this means implementing and supporting (possibly new and specific) forms of ICT in education in the different faculties (with their own departments and expertise), where each faculty has its own organisational structure and ways of decision making. Although a same general structure may apply in each faculty or department because of central policy, it is possible that different decisions will be made on the same issues related to ICT in education: decisions made at the institutional level can have different effects in the various faculties. It can be assumed that by implementing policies in relation to using new forms of ICT in education, some faculties will make heavy use of new technologies, others will use some forms of ICT and some will not use ICT in any systematic way in educational delivery. It is also true that faculties will often adopt a new form of ICT in education without intervention from the university's central level. In other words, a policy or a procedure issued by the university at the central level can have different effects and can even interfere with the initiatives that are adopted by the individual faculties and departments. This is one of the objects of research in this study.

Overall, it can be said that there is a process of change involved in both the decision to adopt or to evolve toward some new form or forms of ICT in education and in the implementation of these forms of ICT. In this research the focus will be on a specific starting point: the period in time that a policy-making unit in higher education, a university, faculty or department, starts the decision process toward supporting some specific form(s) of ICT in education with the intention to make a strategic decision about this support. The consequent actions and processes in relation to this decision constitutes the 'change' that will be examined. In other words, the process if initiation, implementation and institutionalisation as described in the previous section is the main focus of research. From what has been discussed in the previous sections it can be expected that more evidence for initiation and implementation will be found than for institutionalisation or integration of new forms of ICT in education. This study will examine why the decision to support ICT in education is made, which factors have an influence on this decision and what happens with this decision in terms of implementation of the chosen form of ICT. The research question that forms the basis for this research will be presented in Section 1.3, followed by sub-questions to clarify this overall research question.

1.3 Research questions

Given the identification of the context of universities in a changing environment and the idea that supporting and implementing ICT in education is a change process, the overall research question of this study is:

"(a) Which factors effect change processes in universities with regard to implementing a new form of ICT in education, and (b) what effect does the choice for this form of ICT have on the implementation of ICT in education in the faculties and departments?"

The research question assumes that the process of implementing a new form of ICT in education and implementing this form of ICT occurs in an organisational unit within a higher education institution. This organisational unit is the unit where a strategic decision is taken or policy is made. This could be at the central level of the university, but also at faculty or department level. Because the process of organisational change is not unique for implementing a new form of ICT in education and can be described in more general terms first a more theoretical issue is explored in this study by answering the following questions:

1. *How can organisational theories help the understanding of change processes in universities*? and
2. *How can these theories be applied to the decision to implement and integrate new forms of ICT in education?*

With the answers on these questions the actual overall research question can be answered. The overall research question is therefore divided into six sub-questions as described below.

ICT in education in itself introduces another field of research. In addition to a definition of ICT in education that will be used throughout this dissertation it is of particular interest to systematically identify which forms of ICT are available and which forms are being chosen by universities. Choosing for supporting a specific form of ICT in education does not only involve decisions about technology and teaching and learning processes; it is also part of an

institutional strategy. Therefore the next sub-questions are related to influences on the broader strategic choice:

3. *What are major forms of ICT use in universities?* and
4. *Which factors have an effect on the decision to adopt or support a specific form of ICT in education at a particular university*

To examine how the decision to adopt or support a specific form of ICT relates to a certain profiles of a university the following subquestion is formulated as

5. *What are the key variables in profiles of universities that follow alternative ways to support ICT in education?*

The choice for a specific form of ICT in education has consequences for the implementation of the change. The next sub-questions are therefore

6. *What effect does the choice of a specific form of ICT have on the implementation of this form in the faculties and departments?*
7. *Which forms of ICT are actually implemented in the faculties and departments?* and
8. *What conditions influence the implementation of these forms of ICT in different educational settings?*

The subquestions 1, 2, 3 and 4 relate to the first part of the overall research question, concerning factors that effect change processes in universities with regard to implementing a new form of ICT in education. The subquestions 5, 6, 7 and 8 relate to the second part of the research question, with regard to the effect that the choice for a new form of ICT has on the implementation of ICT in education in the faculties and departments of a university.

1.4 Overview of the study

Questions related to organisational change are discussed in Chapter 2. Two specific theories on change processes, Resource Dependency Theory and Institutional Theory, are examined. These theories help to establish a theoretical framework about change processes in organisations and in universities in particular and provide an answer to Research Questions 1 and 2.

Chapter 3 describes commonly used terms with regard to ICT in education, such as telelearning and distance learning and provides an overview of ICT-related systems now in use in education. Also, factors that can be found in the current literature in relation to using new forms of ICT in education will be identified. Next it is argued that implementing and integrating new form of ICT in education is a change process for universities. In Chapter 3 the Research Questions 3 and 4 are discussed.

In Chapter 4 the research questions, theories on organisational change and issues related to ICT use in education are combined. As a result the answer to Research Question 2 is discussed and the way to examine Research Questions 5, 6, 7 and 8 is described. The literature study in which a first attempt is made to answer the Research Questions 5, 6, 7 and 8 is described in Chapter 5. The results of Chapter 5 lead to a series of case studies in

which the research questions are further examined verified. Therefore Chapter 6 starts with a general introduction into case study methodology. Based on the issues covered in this introduction preliminary decisions are made in relation to the proposed methodology for the case studies for this research. To review these decisions a test case study is designed and carried out. Chapters 6 reports on the design and the results of the test case study, and also on an evaluation of the methodology that was used. Recommendations in relation to the methodology for four subsequent case studies in European universities are derived.

Using a methodology that is based on the recommendations of Chapter 6 the case studies that are carried out at the four European universities are described as separate cases in Chapter 7. The cross-site analysis to compare the different cases is described in Chapter 8, combined with an analysis and synthesis of the results. This dissertation concludes with Chapter 9 in which the conclusions are discussed and the applicability of what has been the result of this study is described.

2 Organisational change

As described in Chapter 1, change processes relating to ICT in education in universities are ongoing processes. It was said that implementing and integrating some new form of ICT in education is a form of organisational change, particularly related to second-order changes, in which goals, structures and roles are changed. This implies that more information about organisational change theories is needed in order to understand change processes in organisations in general as well as the specific organisational change of supporting a new form of ICT in education. This chapter gives an overview of the university as an organisation and the rationale for choosing two specific organisational change theories (Institutional Theory and Resource Dependency Theory) in Section 2.1. In Section 2.3 and 2.2 the two organisational change theories are described. In Section 2.4 the two theories are compared and common questions that can be asked with the theories as background information are given. This chapter concludes with a discussion about the relation between the theories and the research questions in Section 2.5. This chapter thus addresses the sub-questions 1 and 2 : *How can organisational theories help understand change processes in universities?* and *How can these theories be applied to a universities decision to adopt or support some new form of ICT in education?*. Section 2.5 provides a summary of this chapter.

2.1 The university as an organisation

In this research a university is regarded as an organisation. This type of organisation has existed in Europe since the Middle Ages; the oldest university of the western world, the University of Bologna, has celebrated its ninth centenary. And since the beginning of the founding of universities they have remained more or less the same with regard to organisational structure. This is remarkable, considering the changes that companies and industry have undergone. But universities have not changed much in the past centuries and generally speaking universities all over the world have a similar kind of organisational structure. The university is lead by an academic (rector, president or vice-chancellor) and consists of faculties and departments related to different study disciplines. At the faculties and departments the academic staff and students can be found.

Because in this research it is assumed that supporting some new form of ICT in education is a form of organisational change for a university, it is imperative that a university that decides to use a new form of ICT in education is able to cope with this change. There are some fundamental characteristics of higher education organisations that affect their ability and capacity for change (Gornitzka & Maassen 1999). These characteristics are related to the governance structure and the distribution of authority. Authority at universities lies in the professional expertise of the academic community. This means in general that there is a strong diffusion of power and decision-making, because the academic community consists of many professional experts. With these characteristics in mind some general remarks are made about organisational change and organisational adaptation before going to the descriptions of the two organisational change theories that are used in this research.

Organisational adaptation occurs when an organisation changes some characteristic of itself to make it better fit its situation, thereby aiming at the improvement of the organisational performance. As Gornitzka and Maassen (1999) say, organisational adaptation is a deliberate attempt of a university to change any aspect of its organisational structure as a reaction to or in anticipation of external developments. But in addition to external developments also intra-organisational or contingency factors such as size or diversification can play a role in adapting to some form of change.

There are several theories that describe and explain organisational change and organisational adaptation. Examples of these theories are the Contingency Model (Scott, 1981), Cultural Theory (Thompson, Ellis, & Wildavsky, 1990), Institutional Theory (Scott, 1995; Powell & DiMaggio, 1991) and Resource Dependency Theory (Pfeffer & Salancik, 1978). To understand organisational change events and aspects it is useful to make use of insights of several theories. Based on what has been written in Chapter 1 in relation to influences from government, market forces and changes in demography Institutional Theory and Resource Dependency Theory have been chosen to form the basis of this study about organisational change. The other theories are less appropriate for this study. For instance, the contingency model uses a simple model of exchange where organisational action is taken in response to the environment, but the environment itself is not affected by organisational action (Gornitzka & Maassen, 2000). This somewhat limited view on organisations, perceived as reactive, seems to be inappropriate in this study. The Institutional Theory and Resource Dependency Theory provide different insights in why and how organisations react to changes, as well as providing some common characteristics of reactions of universities to change that are used throughout this research. The two theories are described in Sections 2.3 and 2.4.

2.2 Institutional Theory

The first organisational change theory that is used in this research is Institutional Theory. Within Institutional Theory there are several perspectives. It is possible to describe Institutional Theory as an inclusive model, integrating the different approaches that exist within this theory. However, Scott (1995) argues that this inclusive model does not take into account the important divergent conceptions within the model. Scott describes three ways of looking at Institutional Theory. These differences are based upon (a) varying *emphases* on institutional elements, (b) varying *carriers* of institutional elements and c) varying *levels* of institutional elements. In the Sections 2.2.1 to 2.2.3 Scott's rationale is described. Section 2.2.4 describes the overall assumptions of the theory.

2.2.1 Varying emphases on institutional elements

An institution is described as consisting of cognitive, normative and regulative structures and activities that provide stability and meaning to social behaviour (Scott, 1995). The cognitive, normative and regulative structures get equal attention, but various theorists within Institutional Theory stress one of these structures as more important than the others. To accommodate this, three pillars of institutions have been identified. These are (a) the regulative pillar, (b) the normative pillar and (c) the cognitive pillar.

- Factors that are of influence on the change processes within the *regulative pillar* (the most conventional pillar) are rule-setting, monitoring, sanctioning activities. The primary mechanism of control is coercion (DiMaggio & Powell, 1983).
- Factors of influence in the *normative pillar* are normative rules that introduce a prescriptive, evaluative and obligatory dimension into social life. The normative system includes both values and norms. Normative systems define goals or objectives and designate appropriate ways to pursue them. Roles, specialised values and norms that apply only to selected types of actors or positions are important. Shared norms and values are the basis of a stable social order.
- The *cognitive pillar* stresses the centrality of cognitive elements of institutions: the rules that constitute the nature of reality and the frames through which meaning is made. Factors of influence are symbols (words, signs, gestures), interaction, shared meanings and constitutive rules which involve the creation of categories of social actors and the construction of typifications. A cognitive conception of institutions stresses the central role played by the socially mediated construction of a common framework of meaning. Morge and Contractor (1997) describe in this regard cognitive social structures as developed by Krackhardt (1987) to characterise an individual's perceptions of social networks or organisations. Cognitive social structures assume the status of socially shared, structural 'taken-for-granted-facts' by individuals about the predictable and recurrent interactions among individuals in the network, even if these cognitions are at variance with the actual communication.

2.2.2 Varying carriers of institutional elements

In addition to the different emphases on cognitive, normative and regulative structures Scott identifies three different carriers (or repositories) of institutional elements: cultural, social structure and routine carriers. These carriers exist in all three pillars mentioned above, with their different emphases.

- *Cultures* are carriers that rely primarily on interpretative structures. Some types of cultural beliefs will be specific to a given organisation or one of it's subsystems. Other cultural systems will operate at a more general level.
- *Social structures* are carriers that rely on patterned expectations connected to networks of social positions, the role systems.
- *Routines* are carriers that rely on patterned actions that reflect tacit knowledge of actors, deeply integrated habits and procedures based on unarticulated knowledge and beliefs.

2.2.3 Varying levels of institutional elements

A third way of looking at Institutional Theory is to make a distinction at which level the varieties of the theory are applied. Scott identifies six categories of levels, World system, Societal, Organisational field, Organisational population, Organisation and Organisational subsystem. While institutions can be capable of operating at different levels, some are restricted to operating within organisational sub-units, whereas others function at levels as broad as that of world systems. These levels can be combined with the three pillars described earlier.

2.2.4 Overall assumptions of Institutional Theory

Even though there are varying emphases on and carriers and levels of institutional elements, there are some overall assumptions within Institutional Theory. The theory describes

organisations as groups of people who embody and enact loosely coupled standardised packages of rules, procedures, and beliefs (Powell & DiMaggio, 1991). These standardised packages, or "rationalised myths" (Meyer & Rowan, 1977), are adopted primarily to maintain organisational legitimacy in the eyes of powerful external actors and belief systems. They are rationalised in the sense that a particular organisational practice is regarded as the single best and necessary means for assuring a desired outcome. Maintaining organisational legitimacy in the eyes of external bodies, such as government regulators, professional organisations, and powerful clients, contributes to the survival of the organisation.

Over time, the institutionalised packages become "taken-for-granted": organisational actors can no longer think of legitimate alternatives, and the packages become extremely difficult to change. They can even be an obstacle to change when they are deeply embedded in an organisation (Kling et al, 1997; Kling & Iacono, 1998). On the other hand, the routinised activities of an organisation make the organisation more productive and predictable in the short run. According to Kling and Iacono (1998) these routinised activities can be processed in the form of standard guidelines that are followed by the organisation. These guidelines may be formal rules and regulations, informal practices which people carry out for the many activities which are not subject to formal rules, and may even be the routine informal practices which people routinely carry out when they work around formal rules.
The application of Institutional Theory suggests that in response to changes in societal expectations, a university will need to legitimise its role when seeking resources (Bealing, Riordan, & Riordan, 1996). The perceived legitimacy of that organisation or unit is generally assumed to depend on the acknowledgement that the structure, function, and domain of that organisation are perceived as proper, useful, and not in conflict with those of other key actors in the environment.

2.3 Resource Dependency Theory

In this section a brief overview of Resource Dependency Theory is given and factors that effect change processes which can be derived from this theory are described.

Resource Dependency Theory is an organisational change theory that assumes that organisations are flexible and that the task environment, the social environment and the effect of state pressures on organisations have an influence on organisational change (Pfeffer & Salancik, 1978, Pfeffer 1982). But, as Maassen, Neave and Jongbloed (1999) point out, rather than being passive recipients of environmental forces, Resource Dependency Theory implies that organisations will make strategic decisions about adapting to the environment. Resource Dependency Theory rests on the fundamental assumption that all organisational action is first and foremost directed at securing institutional survival. Despite other goals and aims, survival is the core objective of every organisation (Goedegebuure & Meek, 1994).

Organisations need resources to survive. Not all resources are equally important for the survival. The two basic resources are money and authority (Benson, 1975), but different organisations can have different resources that are of importance.

Organisations obtain resources for survival from their environments (Pfeffer, 1982) and the environment consists of others on whom the organisation depends for various resources. The level of dependence is determined by the resource's importance, the discretion by those who control resource over its use and the degree to which those in control have a monopoly. These dependencies are controlled by adapting or altering constraints, negotiating with the environment and by changing the environment by political action. Resource Dependency Theory says that the more control over resources an organisation has, the more power the organisation has, and consequently, the higher the incomes of the organisation are. This means that the dependence on the environment is not a one-way process, because the environment is dynamic in that it consists of other organisations with which an organisation interacts. Therefore an organisation is shaped by the environment, but in turn changes the same environment (Goedegebuure & Meek, 1994).

Consequently, organisations respond eagerly to the demands of outside organisations that control critical resources. Groups within organisations who manage relations with powerful external organisations gain internal influence. Organisations strive to increase their autonomy relative to powerful organisations in their environment, and organisational sub-units seek autonomy from each other (Kling et al., 1997). It is assumed that organisational interest groups are able to control the deployment of resources and technologies in the physical work settings and that they usually obtain the outcomes they intended (Pfeffer, 1982).

From this it can be seen that power is an important concept within Resource Dependency Theory. This is discussed by Pfeffer (1981) who states that it should be clear that the extent to which the resources being provided are truly critical to the organisation determines the limitations of the organisation's ability to resist becoming dependent on such funds, and thus provides those who control the funds with power. In other words, an organisation should be aware of what is important in order to be able to control the pressures from the external world.

In relation to this Goedegebuure and Meek (1994) argue that organisational action is aimed towards maximising possession of critical and scarce resources so as to create a positive power differential with other organisations in the environment. This power differential will result in actions by an organisation to maintain superiority and to avoid domination, especially if the environment threatens the supply of critical resources.

According to Gornitzka and Maassen (1998) to understand organisational change one should investigate the way organisations perceive their environment, how they act to control and avoid dependencies, the role of organisational leadership in these processes, as well as the way internal power distributions affect and are affected by external dependencies. The key element in the factors mentioned by Gornitzka and Maassen is strategic choice. This means that a decision is made among a set of possible alternatives in an organisation's dealings with the environment, while there is never just one optimal course of action. Gornitzka and Maassen stress the importance of internal power arrangements and distributions.

2.4 Comparing Institutional Theory and Resource Dependency Theory

From the descriptions of the two organisational change theories it can be concluded that Resource Dependency Theory and the Institutional Perspective share two basic assumptions (Oliver, 1991):
- organisational choice and action are influenced by various external pressures and demands;
- organisations must be responsive in order to survive.

But the two approaches do not converge on two central issues:
- the extent of the capability to react to changes in the environment of the organisation;
- the way to react to changes in their environment (Oliver, 1991).

Oliver (1991) applies the convergent insights of Institutional and Resource Dependency Theories to the prediction of strategic responses to institutional processes. For that purpose Oliver identifies five questions that an organisation has to answer in order to decide how to react to a change. The factors which form the basis of the answer to the questions can be categorised into two main categories, the *context* of organisational behaviour and the *motives* of organisational behaviour. Both categories contain the three convergent assumptions of Resource Dependency Theory and Institutional Theory, described in Sections 2.4.1 and 2.4.2. At the end of this section organisational change questions related to the two theories are discussed (Section 2.4.3).

2.4.1 The context of organisational behaviour

The context of organisational behaviour relates to the way an organisation reacts to the environment. Both Resource Dependency Theory and Institutional Theory assume that organisational choice and action are constrained by various external pressures and demands, that organisational environments are interconnected and that the survival of the organisation depends on the responsiveness to external demands and expectations.

Within these convergent assumptions there are divergent focal points. These focal points differ with respect to the extent of and the way to react to changes. Institutional Theory focuses on the pressures and constraints of the institutional environment itself (rules, laws, goals, etc. within the organisational structure), whereas Resource Dependence Theory emphasises the task environment and the necessity to adapt to and cope with environmental uncertainty.

According to Oliver (1991) these differences in responsiveness to the environment reflect divergent assumptions about the degree of choice. Resource Dependence Theory stresses active choice behaviour in order to respond to the environment. Institutional Theory inclines towards a more non-choice behaviour in that it is more occupied by internal structures and their relation to the environment. This relates to the so-called “taken-for-granted” packages as mentioned in Section 2.2.1.

This also affects the way Institutional Theory responds to external demands. Pressures or demands are more or less invisible because of the institutional processes that are taken for granted. The focus is more on the adherence to rules and norms, whereas Resource

Dependence Theory focuses more on adaptation and active management of resources. Summarising this gives Table 1:

Table 1 Comparison of Institutional and Resource Dependence Theories (context of organisational behaviour)
(adapted from Oliver, 1991)

	Convergent assumptions	*Divergent foci*	
		Institutional Theory	Resource Dependence Theory
Context of organisational behaviour	Organisational choice is constrained by multiple external pressures	Institutional environment Non-choice behaviour	Task environment Active choice behaviour
	Organisational environments are collective and interconnected	Conforming to collective norms and beliefs Invisible pressures	Coping with interdependencies Visible pressures
	Organisational survival depends on responsiveness to external demands and expectations	Isomorphism Adherence to rules and norms	Adaptation Management of scarce resources

For example, from Table 1 it can be seen that if the choice to change by an organisation is constrained by for instance diminishing funding external pressures the organisations that can be associated with the Institutional Theory will accept the pressure because it is believed that there is not much that the organisation can do to change this specific external pressure. Organisations associated with the Resource Dependence Theory will actively search for new alternatives of funding in order to respond to external pressure.

2.4.2 The motives of organisational behaviour

Both Resource Dependency Theory and Institutional Theory agree that organisations are looking for stability, predictability and legitimacy and that they are interest driven. Within these assumptions there are again divergent interpretations and emphases. Institutional Theory for instance focuses on the reproduction of existing organisational structures. Organisations rely on routines and collective norms. Resource Dependency Theory is more focused on reducing environmental uncertainty by exercising power, control or negotiation. External pressures have to be controlled, while within Institutional Theory an attempt is made to conform to the demands.

Looking for legitimacy in order to show the social worthiness of the organisation is an issue that is important in both theories, but Resource Dependency Theory focuses more on the instrumentality of this worthiness. Institutional Theory assumes that it is important to conform to the social norms, but Resource Dependency Theory is more concerned with the strategies to alter a situation in such a way that conformity is less necessary.

The issue of ‘interest-driven organisations’ is for Institutional Theory a question of defining institutional interest. For Resource Dependency Theory it is more a question of making calculative presumptions. It can be said that Institutional Theory emphasises agreement or compliance that is self-serving, whereas Resource Dependency Theory emphasises non-

compliance, including the ability to maintain autonomy over decision making and the possibility to adapt to (and control) external circumstances. This is summarised in Table 2:

Table 2 Comparison of institutional and resource dependence perspectives (motives of organisational behaviour)
(adapted from Oliver, 1991)

	Convergent assumptions	*Divergent foci*	
		Institutional perspective	Resource dependence perspective
Motives of organisational behaviour	Organisations seek stability and predictability	Organisational persistence Habit and convention	Reduction of uncertainty Power and influence
	Organisations seek legitimacy	Social worthiness Conformity to external criteria	Resource mobilisation Control of external criteria
	Organisations are interest driven	Interests institutionally define Compliance self-serving	Interests political and calculative Non-compliance self-serving

For example, from Table 2 it can be seen that if organisations seek legitimacy to demonstrate to the environment that the organisation is social accountable, the organisations, according to Institutional Theory, will conform to the criteria that have been decided upon by this environment. By upholding the norms of the environment the organisation sees itself and is seen as social worthy. Organisations associated with the Resource Dependence Theory will also seek for legitimacy, but the organisation will try to influence the criteria that have been set by the environment.

2.4.3 Strategic response to change

The perspectives presented in Table 1 and Table 2 are related to the context and motives of organisational behaviour and can be used to predict strategic responses of organisations. Typically an organisation can respond in five ways: (a) agree, (b) compromise, (c) avoid, (d) defy, and (e) manipulate. To know how to react to a change the organisation has to answer the following five questions:

1. Why is the organisation being pressured to conform to institutional rules or expectations? (the cause of the change)
2. Who is exerting institutional pressure on the organisation? (the constituents of the change)
3. To what norms or requirements is the organisation being pressured to conform? (the content of the change)
4. How or by what means are the institutional pressures being exerted? (the control of the change)
5. What is the environmental context within which institutional pressures are being exerted? (the context of the change)

Oliver (1991) states that the answers to each of the five questions can be categorised in two values of a single dimension. This is represented in Table 3.

Table 3 The five organisational change questions and their answer values

Organisational change question	Answer values
Cause *Why is the organisation being pressured to conform to institutional rules or expectations?*	Value 1, Social fitness: secure the legitimacy of the choice to conform to the change in relation to social motives (expectations, culture, habits) Value 2, Economic fitness: secure the legitimacy of the choice to conform to the change in relation to economic motives (obtaining resources and funding, distribution of power)
Constituents *Who is exerting institutional pressure on the organisation?*	Value 1, Multiplicity of constituent demands: involvement from (and consequently influence of) other (external) interested persons in the choice to change Value 2, Dependence on institutional constituents: internal involvement in the choice to change
Content *To what norms or requirements is the organisation being pressured to conform?*	Value 1, Consistency with organisational goals: the change to be implemented conforms with the current practice in the organisation Value 2, Constraints imposed on the organisation: the change to be implemented requires that specific conditions are met that were not practised before
Control *How or by what means are the institutional pressures being exerted?*	Value 1, Coercion: the implementation of the change is enforced by an actor or institution within the organisation Value 2, Voluntary: the implementation of the change is expected to proceed via a voluntary diffusion of existing norms and rules
Context *What is the environmental context within which institutional pressures are being exerted?*	Value 1, Environmental uncertainty: the environment in which the change takes place is uncertain Value 2, Environmental interconnectedness: the environment in which the change takes place is predictable

In the next section the application of the organisational change theories and the five questions with the answer values is discussed.

2.5 Summary related to organisational change

This chapter has described two organisational change theories (Institutional Theory and Resource Dependency Theory) in Sections 2.3 and 2.2 and the convergent insights of these theories in Section 2.4. In Section 2.5 some explorative examples were given in relation to using the theories to explain the connection between ICT and organisational change processes. To summarise this chapter an overview is given in Sections 2.5.1 - 2.5.2 of the topics related to organisational change as described in the Sections 2.1-2.5. These topics will be followed-up in Chapter 4 in which a combination of the organisational change theories (described in this chapter) and theory in relation to ICT in education (described in Chapter 3) is made.

2.5.1 The university as organisation

It was described that universities have not changed much in the past centuries and generally speaking universities all over the world have a similar kind of organisational structure. Interestingly enough universities did survive over the ages. The question remains if universities really did not adapt to external influences, or that they indeed did change in order to survive. In general it can be said that a university is led by an academic (rector, president or vice-chancellor) and consists of faculties and departments related to different study disciplines with the academic staff and students. The key characteristics of a university have particularly to do with the governance structure and the distribution of

authority. This is of course true for most organisations, at universities specifically this relates to their core business activities with regard to education and research.

2.5.2 Institutional Theory and Resource Dependency Theory

Institutional Theory describes organisations as groups of people who embody and enact loosely coupled standardised packages of rules, procedures, and beliefs. Maintaining organisational legitimacy in the eyes of powerful external actors and belief systems is important. When responding to changes, the organisation will need to legitimise its role when seeking resources. Resource Dependency Theory on the other hand argues that organisations need resources to survive, resources for survival are obtained from the environment. It is believed that organisations respond eagerly to the demands of outside organisations that control critical resources. Consequently, power over these resources is an important concept, a key element in this is strategic choice. The theories share two basic assumptions:

- organisational choice and action are influenced by various external pressures and demands;
- organisations must be responsive in order to survive.

The theories differ in:

- the extent of the capability to react to changes in the environment of the organisation;
- the way to react to changes in their environment.

By combining Institutional Theory and Resource Dependency Theory five organisational change questions with answer dimensions were formulated and presented in Table 3, related to the cause, the constituents, the content, the control and the context of change. It was argued that universities and their faculties or departments react in a specific way to internal and external pressures and that the five organisational change questions provide insights in the reaction of the university to internal and external pressures.

2.6 Application of the two theories in relation to the research question

What purpose do these two theories and the comparison of the theories have for looking at factors that effect change processes in universities with regard to supporting some new form of ICT in education? There are three main purposes. First, the theories help to position the research question in a context of organisational change. Second the theories identify the necessary background for the research. Third the theories form the basis for the research questions and analysis of this study.

From the two theories it can be confirmed that organisational environments, and therefore also universities and their faculties, react in a specific way to internal and external pressures (see Table 1 and Table 2). Oliver's research in relation to the factors that predict responses or strategies and the degree of organisational congruity or resistance to internal and external pressures (presented in Table 3) are used in this research during the literature study as described in Chapter 5 and the case studies as described in Chapters 6 and 7.

Reflecting upon the context of the research question, using new forms of ICT in education, and the relation between organisational change and the implementation of new forms of ICT in education, examples can be found in relation to reactions of universities to this issue.

Jaffee (1998) for instance argues that to understand possible opposition and resistance to new forms of ICT in education, Institutional Theory provides a number of major insights. He argues that there are a wide variety of environmental forces that stimulate the transformation of organisational practices in higher education in general and that of using new forms of ICT in particular. Even though Resource Dependency Theory may assume that there are rational and functional reasons for organisations to adapt to the changing environment, Jaffee argues that even though these forces exist, institutions are highly resistant to these increasingly powerful environmental pressures: standard operating teaching and learning procedures remain intact for long periods of time, they appear impervious to external forces. This pattern of organisational non-responsiveness fits into the logic of Institutional Theory (Jaffee, 1998).

Other examples of the relation between ICT and organisational change can be found. Florini and Vertrees (1989) for example say that organisational or institutional problems can hinder the introduction of new technologies. Too often when attempts are made to introduce and maintain a new technology in an institution, insufficient attention is paid to critical contextual variables such as institutional politics, comprehensive costs, and the need for new alliances. The better the fit between the system to be implemented and the social context in which it will be embedded, the greater its chances of acceptance and use as originally intended (Kling & Iacono, 1998).

The results from this chapter suggest that in response to Research Questions 1 and 2 (How can organisational theories help the understanding of change processes in universities? and How can these theories be applied to the decision to implement and integrate new forms of ICT in education?) the following conclusion can be formulated: A combination of organisational change theories and factors that could influence the decision of a university to adopt some new form of ICT in education is possible and functional. The question with regard to the application of the theories to a university's decision to adopt or support some new form of ICT in education will be further elaborated upon in Chapter 4 in which the organisational change theories are combined with factors that can be identified that could be important in the decision to adopt new forms of ICT in education. These factors and more information about new forms of ICT in education are described in Chapter 3.

3 ICT in education

Information and communication technology (ICT) in education has been described in Chapter 1 as (network) technology or Web-based systems that can be used in education as a major response to the general changes and trends in society influencing universities. This chapter explores possible factors that can effect change processes in universities with regard to implementing a new form of ICT in education. Before questions related to these factors can be answered it is necessary to define specific concepts and terminology related to ICT in education in order to get a better understanding of this domain. In Section 3.1 a definition of ICT in education as it is used throughout the research is given. Section 3.2 describes some organisational approaches to flexible learning in which new forms of ICT can be used. The technology that can be used to implement new forms of ICT in education and some examples of new forms of ICT are described in Section 3.3, thereby answering Research Question 3 related to the major forms of ICT that are in use at universities. Factors that can be found in the current literature in relation to implementing and integrating new forms of ICT in education are identified in Section 3.4, which results in an answer to research Research Question 4 related to factors that have an effect on the decision to adopt or support a specific form of ICT in education at a particular university. Section 3.5 provides a summary of this chapter.

3.1 ICT in education, a definition

At this moment ICT is emerging in all of the aspects of today's society, including education. Over the last two decades ICT has become more enhanced, improved and affordable. Special educational products such as simulations and computer based training have been extensively developed and other technologies such as the Internet are increasingly being used in educational situations.

In this research 'Using new forms of ICT in education' means using all kinds of information and communication technologies to make connections among persons and resources that can be used to support the teaching and learning process. In this definition ICT is not limited to Web-based or network technology. In this study ICT can range from the World Wide Web and e-mail to videoconferencing, computer-based training and CD-ROMs. This has been done to gather current issues related to the use of forms of ICT in education that are new to universities, without focusing solely on Internet-based or Web-based systems. With this broad definition it is possible to identify factors that have an influence on the use of all these technologies.

3.2 Organisational approaches to flexible learning

In this section several organisational approaches to flexible learning and their relation to new forms of ICT are discussed. First, in Section 3.2.1 more attention is given to the need for flexibility and the role of ICT in supporting this flexibility. Following this several alternatives are discussed that can be seen as ways to support flexibility for learners. These alternatives are telelearning, open learning and distance learning (Section 3.2.2) and single and dual mode education (Section 3.2.3).

3.2.1 The need for flexibility

Chapter 1 mentioned several reasons for universities to steer their involvement in the development around ICT in education. In that description flexibility was one of the most important concepts. Flexibility in response to demographic changes, but also the need for flexibility to cope with market forces and the demands from the knowledge economy. Thus the concept of flexibility, especially related to ICT in education needs to be explored further. Collis (1999a) and Collis and Moonen (2001) identify five forms of flexibility that can be supported with ICT. These forms are

- *Flexibility in location*, where the learner can carry out (some of) the different learning activities associated with a course;
- *Flexibility in programme*. Assuming that the learner has relevant previous experience, subgroups of courses can be chosen in terms of the learner's needs and interests;
- *Flexibility in types of interactions* within a course, for example so that students who benefit from group interaction and group-based work can choose these sorts of opportunities, while other students who benefit more from the freedom to organise their own times and ways of studying can also be accommodated within the same course;
- *Flexibility in forms of communication* within a course, so that learners and instructors have a wider variety of ways of communication;
- *Flexibility in study materials*, so that the students have a wider choice of resources and modalities from which to study (Collis, 1999a; Collis & Moonen, 2001).

In each of these cases of offering flexibility, (new) forms of ICT applications can be identified. Collis (1999b) for instance identifies several applications of networked computer communications, categorised by five major learning-related purposes. Her approach emphasises the functionalities (that what the user can do with them)of what she called computer-communications applications (in this research referred to as ICT in education). The applications and their purposes are represented in Table 4.

Table 4 Applications of ICT in education, general categories in terms of learning-related purposes

(adapted from Collis, 1999b)

Major purpose	Applications of ICT in education
Publication, information dissemination	HTML editors; Web-sites and the browsers to access them, Web-sites associated with database environments; software to facilitate file transfer and document attachments to e-mail; tools for cross-application format retention (i.e. pdf)
Communication	E-mail systems, computer-conferencing tools, including Web-boards and other forms of WWW-based conferencing; Web-sites offering communication options including *mailto:* for the direct sending of e-mail and common gateway interface (CGI) forms for structured communication; software for Internet telephony; software environments for audio-video desktop conferencing, for voice-email, for creating video attachments for e-mail; software systems for text-based chat
Collaboration	Groupware, which includes application-sharing software, shared workspaces, WWW-based shared workspaces, WWW-based application sharing, workflow tools; computer conferencing suites; Web-sites designed for collaboration support; tools to allow collaborative writing on documents that are then commonly available to a group
Information & resource handling	WWW-based search engines; distributed database systems; Web-sites designed for information organisation, access and sometimes creation; tools to retrieve and display distributed multimedia resources stored as digitised (streaming) audio and video
Specific for teaching and learning purposes	Applets for interactive software (such as quizzes and simulations) accessible via Web-sites; testing systems accessible via Web-sites; video-capture tools for lecture or presentation capture; video-conferencing (point-to-point and multicasting) for lecture participation; video-on-demand and streaming video for lecture capture and re-use; WWW-based course-support environments; database-generated course-support systems, integrating many or all of the applications in this table along with management tools

The applications of ICT in education and the general categories in terms of learning-related purposes as presented in Table 4 can be seen as tools for several organisational approaches to flexible learning. Some of these approaches, frequently supported by forms of ICT, are described in the next sections.

3.2.2 Open learning, distance learning and telelearning

Open learning, distance learning and telelearning are three terms that are used in a variety of ways and settings. All of these terms can involve combinations of forms of ICT applications. This sections gives descriptions of the terms and their typically associated ICT applications.

Most conventional institutionalised learning takes place in a closed and prescribed learning environment. This environment is typically a classroom at a certain location with an instructor and face-to-face lectures. The pace of teaching and learning is largely defined by the progression of content within the course itself. In general this form of learning relies on self study. Open learning is an umbrella term used to describe a variety of educational initiatives reflecting a shift in emphasis from instructor-centred learning to student-centred learning (Scholten, 1999): the learner is central in the learning process, the learner is

responsible for the learning process and the learner is active rather than passive. In other words the learner has a measure of control over the learning process, although both the nature and the extent of this control can differ from one educational setting to another.

Ideally, an open learning environment should not impose any requirements on the learner. It should provide flexibility to the learners, not only in the sense of place and time to study, but also in the sense of entry requirements. Students in an open learning environment are often non-regular students (part-time, second-chance, etc.). This means that their former study may or may not connect to the study they want to follow in the open learning structure. Prerequisites in the form of specific background knowledge are therefore often not required. In other words, open learning provides access to learners with a wide range (or lack of) of initial knowledge and experience. In addition to this open learning programmes will offer a wide choice of study possibilities. Even though an open learning environment does not necessitate the use of new forms of ICT, the use of (network) technologies may enhance the possibility of offering open learning. For instance, by using the opportunities of Web-based ICT applications related to offering extra resources (such as hyperlinks and video fragments) it is possible to provide students additional learning material to catch up with the necessary prerequisites or background knowledge in a flexible way.

Distance learning can be combined with open learning. Distance education is a way to provide higher education to the student's own location, instead of moving the student to the location of higher education. The student's own location can be at home, at work, a study centre in the neighbourhood, at a university, etc. Distance learning is increasingly being looked to as an economical way of expanding educational activities, widening opportunities for student around the world, and making effective use of new technologies which are rapidly emerging (QAA, 1999). But even before these technologies entered the scene distance learning existed. The basic characteristic of distance learning is that physical presence is not required, the student learns at his or her own site, remote from the institute. This means that the learning takes place with the instructor and student geographically separated from each other. Examples of distance learning in the past can be found at open universities and commercial providers of educational material. Written communication, occasional meetings at study centres and telephone communication were used as an extra aid during the learning process.

Taylor (1995) identified several models of distance education. An overview along with typical forms of instrumentation (some of them ICT) is presented in Table 5.

Table 5 Models of distance education and instrumental support
(adapted from Taylor, 1995)

Model of distance education	Instrumentation used
First generation: the correspondence model	Print
Second generation: the multi-media model	Print Audiotape Videotape Computer-based learning Interactive video
Third generation: the telelearning model	Audioteleconferencing Videoconferencing Audiographic communication Broadcast TV/Radio and Audioteleconferencing
Fourth generation: the flexible learning model	Interactive multimedia online Internet-based access to Web-resources Computer mediated communication
Fifth generation: the intelligent flexible learning model	Interactive multimedia online Internet-based access to Web-resources Computer mediated communication using automated response systems Campus portal access to institutional processes and resources

As can be seen in Table 5 with ICT applications extra communication possibilities can be created compared to non-ICT situations. Often this is related to telelearning. However, Collis (1996), describing telelearning as "making connections among persons and resources through communication technologies for learning-related purposes" has not been limited to the third generation model that Taylor (1995) called the telelearning model. According to Collis (1996), making connections implies interactivity and deliberateness. This means that the learner is engaged in learning, but not on his own. The learner makes connections with others (instructor, other students, an expert, etc.) or with specific resources (text, video, databases, etc.) This connection is made via network technology or Web-based systems. According to Collis the persons and resources involved in telelearning may be beyond what the learner could have access to in his ordinary learning context, but they may be also the same persons and resources, made accessible in different ways and at different times than before.

Making the connection among persons and resources can occur in part or entirely through communication technologies. These connections through technologies can be synchronous (live or real-time), or asynchronous. Connections can be made through (a combination of) telephone, cable, networks, etc. Telelearning, as the word implies, has to do with learning and education. This means that the connections made and the resources used are applied for learning-related purposes. A variety of (new) pedagogies and learning approaches can be used.

3.2.3 Single and dual mode education

Two other organisational approaches for flexible learning are single and dual mode education. both of these are increasingly supported by new forms of ICT in education. A distinction can be made between traditional or single-mode universities and dual-mode universities (Chatelard, 1996; Fisser, Moonen, Clar, & van Muylwijk, 1997; Fisser, Moonen, & Collis, 1997).

A single-mode university is a university where students are following traditional courses. There are two ways of following these courses: (a) face to face at a 'traditional university', or (b) at a distance at an open university. At this moment the focus is on the first type of university. All students who are in active enrolment must be physically present at the university for various events such as lectures, practical sessions, seminars and examinations. Resource facilities are also located at the university, mainly a library but increasingly computer facilities. Students may be off-campus for various practical activities, and may do their independent study at home or otherwise off campus, but the focal point of interaction is within the physical boundary of the university campus or campuses.

By dual-mode, the situation where the student enrolling at the university has his choice of options with respect to delivery location is meant. In a full dual-mode situation, the student can decide to fulfil requirements for lecture and seminar attendance, for practical session attendance and for assessment, from on-campus or off-campus locations. Thus, it is possible to follow the same course in two ways, (a) being physically present and (b) following the course at a distance. Many permutations are possible, but underlying them all is more flexibility for the student in terms, at least, of place of study, and systematic provision for support of the student in both on-campus and off-campus participation.

In order to give the opportunity of more flexible learning, universities may consider changing from a single-mode to a dual-mode university. A transition from single to dual-mode provides many new opportunities to universities and students. For universities this means for instance that they can offer more flexible ways of education, attract more students, have a broader range of students and explore the possibilities of new technologies that support telelearning.

Given the above definitions of single and dual-mode universities, six phases are suggested illustrating a university's position with respect to single-mode or dual-mode delivery (Chatelard, 1996):

Phase 1: Single-Mode
Phase 2: Isolated Exploratory Activities, by individuals, not supported by university infrastructure
Phase 3: "Special Event" Activity, supported (to some extent) by university infrastructure
Phase 4: Dual-Mode Development, within one or a few departments, for the regular program itself, supported to some extent by university infrastructure
Phase 5: Dual-Mode into the Mainstream, with the university infrastructure supporting a number of dual-mode situations in a number of departments
Phase 6: Dual-Mode, with the university fully organised to offer location flexibility to students

With these phases it is possible to see where a university is in its transition to dual-mode. After situating the university in one of the phases, further steps can be identified and taken to make the transition complete.

In Section 3.2.1, Table 4, several ICT applications were mentioned. In the table describing applications that are specific for teaching and learning purposes several applications were mentioned such as WWW-based course-support environments and database-generated course-support systems which integrate many or all of the applications mentioned in the table. More about these applications is described in the next section.

3.3 Technology for flexible learning

Section 3.2, Table 4, described a first identification of applications of ICT in education related to specific learning purposes. In that same section, Table 5, models of distance education supported by specific instrumentation was presented. The two tables can be used as a starting for this section, in which several forms of technology that can be used in order to support flexible learning are outlined.

3.3.1 Selection of the technology

According to Collis and Moonen (2001) the choice for technology has been seen in the literature as (a) a selection based on logical analysis from an overall palette of technology choices, or (b) a selection based on explicit empirical comparisons between specific technology alternatives, or (c) both. But Collis and Moonen argue that the choice for technology in education cannot be made from literature studies and that the decision about which technology should be used occurs slowly. The decision seems to be based on what Collis, Peters and Pals (2001) call “the 4-E model” in which the four Es in this model relate to Environment (the institution’s profile with respect to technology use), Education effectiveness (gain from the technology use), Ease of use (ease or difficulty in making use of the technology) and Engagement (personal engagement about technology use for learning-related purposes). According to this model the individual’s likelihood of using new forms ICT in education depends on the judgement of this individual on the four Es. Each of the Es can be more important than the others, based on the preferences of the individual. The main assumption in the Four-E model is that if the sum of judgements of the four Es is positive the individual will use new forms of ICT in education. But which forms are available?

3.3.2 New forms of ICT in education

As has been stated in Section 3.1 in this study ICT can range from a wide variety of technologies that can be used to support education, such as the World Wide Web and e-mail, but also computer-based training and CD-ROMs. Fast networks such as Internet 2, cable connections and ADSL make it easier for users to get connected to the Internet. This gives more possibilities for using new forms of ICT in education. Collis and Moonen (2001) for instance describe video-related technologies (video on demand, streaming video) and the development of wireless and mobile computing. The possibilities for supporting education with wireless computing are examined at this moment (see for instance Hamel, 2001). For a summary of possible (new) forms of ICT Table 4 and Table 5 can be used. In the next section more information is given about Web-based technologies.

3.3.3 Web-based technology, Web-based course management systems and electronic learning environments

Web-based technology is used in education to support (stand alone) Websites and Web-based systems. These systems include information and communication possibilities. Information often refers to general information about for instance a course or a study programme, but can also include resources for the instructor and the student (such as documents, audio and video and hyperlinks to relevant Websites). The communication possibilities of Web-based technology are e-mail, but also discussion lists and Webboards. In addition to information and communication other uses of the technology are possible. Van der Veen for instance describes the possibilities of Web technology for group-based learning, the series of activities in which groups of learners work together in order to complete a learning task (Van der Veen, 2001). The support options for group-based learning in an Web-based environment can include according to Van der Veen the following features:

- Web-based planning tables, a table in which the rows and the columns indicate which, when and by whom educational tasks have to be performed;
- Web-based group archive, a storage environment for group-related materials in digital format which can be accessed by group members via a Web browser;
- Workflow, the automation of an educational process;
- Discussion platforms, an electronic storage environment for messages from the users (students and instructors) over a period of time.
- Video conferencing, communication with other participants via the Internet of a stand alone application;
- Tailor-made Web application, a specially designed storage environment for course-related materials in digital format which can be accessed by instructors and students, using a Web browser and an Internet connection.

With the idea of tailor-made Web applications, many companies and universities have started to develop their own Web-based systems. Well known (inter)national examples of these systems are:

- WebCT, initially developed by the University of British Columbia in Canada;
- Blackboard, developed by the company Blackboard Inc., Washington D.C.;
- Docent, developed by the company Docent Inc., Mountain View, California;
- POLARIS, developed by the University of Maastricht;
- TeleTOP, developed by the University of Twente.

Recently, a study was carried out in the Netherlands in which several commercial Web-based systems were compared for use in higher education (Droste, 1999, 2000). As a conclusion, Droste argues that strategic attention has to be paid to (a) the situation in which a platform is used, (b) the support of specific functionalities in the platform, (c) the support from the organisation for purchase such a platform, (d) technical and maintenance issues and last but not least (e) to the costs of such a platform (Droste, 1999, pp. 39).

The systems listed above are examples of tailor-made Web applications, and are also called course management systems or electronic learning environments. A Web-based course management system is a comprehensive software package that support some or all aspects

of course preparation, delivery and interaction and allows these aspects to be accessible via a network (Collis & Moonen, 2001). Often these course management systems only deal with separate courses and not with the other systems that are in use at the university, such as the personnel database and a system for exams and grades. It is believed that an electronic learning environment can offer a combination of existing systems in order to make one portal for instructors and students from which they can find all necessary information. Mirande, Riemersma and Veen (1997) give a very broad definition of an electronic learning environment. They describe it as a learning environment that uses technology. Jansen, Fisser, and Terlouw (2000) describe an electronic learning environment as an environment that supports and enriches the traditional environment by functionally using new forms of ICT (Jansen, Fisser, & Terlouw, 2000). Electronic learning environments can encompass many of the ICT applications listed in Table 4 and Table 5.

In conclusion, in relation to 'new forms of education' it is important to note that this study aims at finding factors that effect change processes in universities with regard to implementing and integrating a new form of ICT in education. Implementing a new form of ICT in education implies that this has not been done before, or maybe not in a large scale at the particular institution. Therefore, for one university implementing and integrating new forms of ICT in education may mean that the university puts its effort on implementing computer-based training programmes, for another university this is the implementation of a campus-wide electronic learning environment. Relating this to the sub Research Question 3 (what are major forms of ICT use in universities?) it can be said that the major new forms of ICT in education are related to Web-based systems, especially course management systems. In addition other technologies are used, such as video conferencing and computer-based training programmes (software, CD-ROMs). These possible new forms of ICT in education for the particular institutions will be further examined in the case studies, described in Chapters 5, 6 and 7.

It is the intention of this study to find factors that have an influence on the decisions that have to be made about using technology in teaching and learning processes. The next section will therefore make a start with identifying factors that have an effect on the decision to implement and integrate a specific form of ICT in education.

3.4 Factors that effect the implementation of new forms of ICT in education

In this section the a first effort is made to answer Research Question 4, *Which factors have an effect on the decision to adopt or support a specific form of ICT in education at a particular university*? based on a literature review. The factors that can be found are also a first effort to find out under what conditions a specific form of ICT in education is adopted.

This section starts by summarising some factors mentioned by Farrell (1999) in Table 6 to give an indication about particular factors that could be important. The factors can be differentiated in factors that are driving the development of what he calls 'virtual institutions'' (educational institutions that use technology in education), and factors that oppose the development of these institutions.

Table 6 Using new forms of ICT in education, driving and opposing factors
(adapted from Farrell, 1999)

Driving factors	Opposing factors
– The increasing capacity, flexibility, and suitability of ICT to educational applications	– In many parts of the world there is no access to networks
– The continuing decrease in the cost of hardware	– Many learners have no access to the necessary ICT appliances such as computers
– The enabling capacity of the technologies to 'unbundle' functions that have traditionally been provided by one institutions	– Copyright restrictions on the use of instructional products and materials do not promote sharing through collaborative inter-institutional arrangements or through broad international delivery models
– The growth of knowledge, with its attendant consequence of the obsolescence of much what was previously learned, placing an ever-increasing pressure on conventional models of education	– The front-end cost of implementing high-quality virtual models constitutes a major constraint
– The realisation that the quality f the learning experience can be enhanced by applying ICT	– Current systems of learner support are not designed to function effectively in a virtual education environment, creating problems for all but the most capable of independent learners
– The demand from isolated learners for more equitable access and service	– The reluctance of most instructors to embrace the use of new forms of ICT
– The perception of many institutions that the application of ICT will enable them to increase their market share in an environment that is increasingly competitive	– The educational philosophy of many instructors contributes to their reluctance of ICT application
– The need to be seen to be 'keeping up with the competition'	– The transfer of course credits among institutions is a problem for those students who would like to undertake a programme that might be available through virtual methods but would require taking courses from several different institutions
– The expectation by policy makers and administrators that the development of virtual delivery models will reduce costs, increase productivity, and enable expansion without cost increases	– Many people, particularly those who are younger and with less experience as independent learners, when given a choice prefer a traditional face-to-face learning environment.

The above list is not exhaustive, but it is a first overview of possible factors. An other list of possible factors is presented by Moonen and Kommers (1995), who outline in their report some factors described by Ely (1990) that stimulate the implementation of ICT in education. These factors are:

- dissatisfaction with the status quo;
- existence of knowledge and skills;

- availability of resources;
- availability of time;
- existence of rewards or incentives for participants;
- expected and encouraged participation;
- commitment by those who are involved;
- evident leadership.

One other list of key principles that are important for institution-wide implementation of ICT in education is given by Deepwell and Syson (1999): fully utilise central support, simplify procedures, provide local support, build on current practice and always expect change.

From these and other literature about using new forms of ICT in education six groups of factors can be identified that effect the actual use of new forms of ICT in education. These categories are:

1. environmental pressures
2. technology developments
3. educational developments
4. institutional conditions
5. cost reduction
6. support facilities

The groups of factors are described in Sections 3.4.1-3.4.6. At the end of this section a summary is given of relevant factors related to using new forms of ICT in education.

3.4.1 Environmental pressures

Chapter 1, Sections 1.1.1-1.1.5, described the changing environment of the university and its impact on the organisation of the university. Government, policy, market forces, demographic changes, the knowledge economy, the internationalisation of higher education and the increasing demand for lifelong learning were described. Section 1.1.7 discussed the response to these developments in the form of using the possibility of new forms of ICT. Where Chapter 1 discussed the general ideas of the development around a university, this section focuses on specific ICT-related factors.

In relation to what has been said in Chapter 1 with regard to the knowledge economy and accountability, Moonen and Kommers (1995) state in their report that society expects that people are well educated and can contribute to this society. Because ICT is taking a permanent place in society, schools and universities should train their students in order to acquire the necessary skills to work with new technologies in their future jobs. Others such as van Vught (1997), Bates (1997) and Jaffee (1998) agree with this argument.

The increased demand for lifelong learning and its relation to the possibilities of new forms of ICT in education has been discussed (Brown & Duguid, 1995; Winship, 1996; Field 2000). The possibilities of ICT are usually related to offering time- and place independence for the students. With the support of the new forms of ICT, for example a course management system or an electronic learning environment as described in Section 3.3 could support both students at a distance or the regular on-campus students. In relation to lifelong

learning the demand for on-demand training and education as business (university education for employees of companies) (Bates, 1994; Bates, 2000) and tailor-made training products (Bates, 1996) are mentioned in the literature. Again, this relates to using the opportunities of Web-based environments to offer time- and place independence, but also to enhancing the traditional way of teaching with additional resources such as streaming video applications and domain-specific simulations.

Lifelong learning and the increasing amount of part-time students have been described as new developments in society which have their influence on education. Members of increasingly diverse student bodies no longer have the time, the patience, or the money to obey the university's implicit command to assemble at conventional campuses for conventional periods, for conventional forms of teaching (Brown & Duguid, 1995; Field 2000). Gaines (1997) mentions new markets of students and funding. But the most significant resource issue according to Gaines is the development of partnerships because individual institutions do not have the resources to develop all the educational materials they need. Peters, Wills, and Sandelands (1998) describe a new way of education as offering an inclusive approach going beyond societal and political boundaries, offering a rich, multi-faceted learning experience. A university that is using new forms of ICT in education (in their words a virtual university institution) can reach students on a global basis, supported by globally sourced faculty.

Competition between educational institutes is mentioned by several authors (Besser, 1993, Denning, 1996, Gamlin, 1995, Winship, 1996), also in relation to the competing with new providers of education now compete with the universities for students (Kerr, 2001). Coping with a dynamic environment (Bates, 1997) and the ability to respond to threats and opportunities (Davies, 1997) are also important factors for applying ICT in education.

3.4.2 Technology developments

This section relates primarily to what has been said in Sections 3.3.1-3.3.3. Without repeating what has been said in those sections, the following additions can be made. Information and communication technologies have made impressive developments. Until relatively recently software developments in terms of functionality and especially the ease of use have failed to match the spectacular improvements in computer hardware performance (Winship, 1996). Networking technology has developed quickly. Connections via ISDN, ATM and Cable have high potential. Not only the bandwidth of these technology, but also the accessibility of the technology is expanded. This means that more persons can be reached and that more persons can reach the university (see for example Bates, 2000; Collis & Moonen, 2001).

The development of the Internet and the access to the World Wide Web (WWW)have contributed to a wider access to information sources. Knowledge is analysed and new knowledge is created. All this is available to a wide audience. It is expected that the information on the WWW will continue to grow and new navigation tools and search engines will be developed. In addition to the Internet and technologies such as video conferencing other, more advanced technologies emerge. Examples of these are wireless and mobile communication (Collis & Moonen, 2001; Hamel, 2001), voice recognition, virtual reality and automatic language translation (Winship, 1996). These technologies have

a clear potential as teaching and learning aids as well as for modelling and simulation activities.

The push for these new technologies and the “hype” of using new forms of ICT in education is an important factor that has influence on implementing new technologies (Bates, 1996, Gaines, 1997, Gamlin, 1995, Winship, 1996, van Vught, 1997). The basic ICT applications are already part of the day to day life at a university, including office applications such as spreadsheets and word processors and university-wide systems and databanks. Many people are starting to depend on these technologies (Bates, 1997) and are searching for good alternatives in an educational setting. To take advantage of the technologies without losing sight of the resources of the past, a successful university should, according to Brown and Duguid (1995) (a) enable students to engage in open learning, exploration and knowledge, (b) simultaneously provide the resources to help them work in both distant and local communities, and (c) offer them the means to earn exchangeable, equivalent credential for work done in class, on-line or through hands-on experience.

3.4.3 Educational developments

According to Batson (1995) students are more active and therefore more likely to learn when they use ICT. In relation to this the continuum of instructor-centred - student-centred education is an emerging perspective in education, also in relation to ICT in education (Jansen, Fisser, & Terlouw, 1999). In general, the goal is to move as quickly as possible from a more instructor-centred approach in the initial and intermediate situation to a more student-centred approach in the target situation. At least two types of didactical approaches can be distinguished, (a) self-directed learning in which students create their own learning processes, and (b) scaffolding, in which students realise their learning process with generally decreasing help of instructors (Winnips, 2001).

Scaffolding is a didactical approach in which meta cognitive skills can be learned. Scaffolding can be described as a communication process in which support, given by the instructor, gradually decreases. It is a process of gradual reduction of support until the scaffolding is no longer needed (Jonassen, 1996; King, Staffieri, & Adelgais, 1998; Winnips, 2001). The instructor monitors student learning in a careful and individualised way and withdraws support when the student can work on his or her own (Collis, Winnips, & Moonen, 2000).In Figure 1 the process of scaffolding is represented:

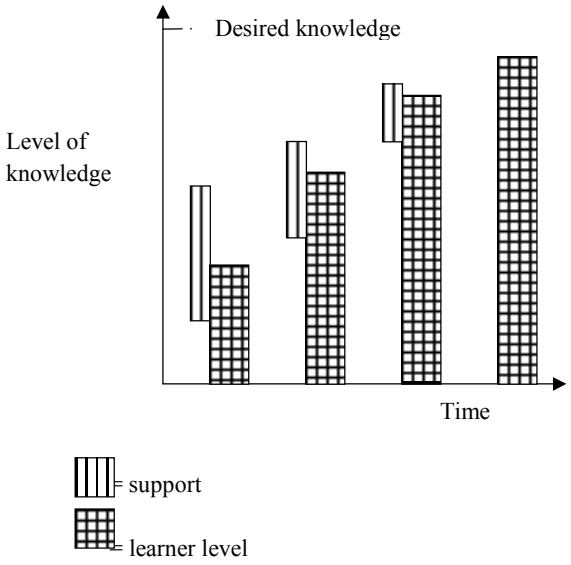

Figure 1 The process of scaffolding
(adapted from Winnips, 2001)

Scaffolding as thus described can relate well to a constructivist learning approach. In this approach knowledge is believed to be actively constructed, tightly connected to the individual's cognitive repertoire and to the context within this activity takes place (see for instance Tabbert, 1993; Philips, 1995; Salomon, 1998). According to Salomon (1998), ICT offers the opportunity of actively constructing knowledge in particular symbolic forms (word, graph, pictures) and structured in particular organisational ways (databases, hypermedia) available for exploration and manipulation. Salomon further claims that not just being exposed to these symbol systems of technology and media, but being actively involved in construction, either individually or collaboratively, makes this possibility a powerful one.

By using technology in education the infrastructure of learning will change (Twigg, 1994). Curricula could be more student-centred, beginning with the question of what students need to learn. Learning materials might evolve so that they are not course-based, but modularised to respond to individual learning needs and preferences. Material could be delivered in a variety of formats depending on the individual's learning style. Evaluation of student learning could be increasingly integrated in each set of learning material. Twigg also foresees a learning infrastructure in which learning can occur anytime and anywhere and in which just-in-time learning will be the norm. Students will access only those learning modules they find necessary, whenever and wherever they need them.

ICT can be used to (a) offer greater time flexibility to students, (b) provide better opportunities for interaction with the lecturer, or to practice skills with peers and (c) make connections with students around the world via the Internet (Mason, 1994). This will mean that communication will become one of the most important features of using new forms of ICT in education. Communication can be seen as a certain amount of interactions that a

student can have with his environment. Sysling and Van Veen (1997) have outlined a model in which the student is the central person in a learning process. The student has different kinds of interactions with his environment. This is shown in Figure 2.

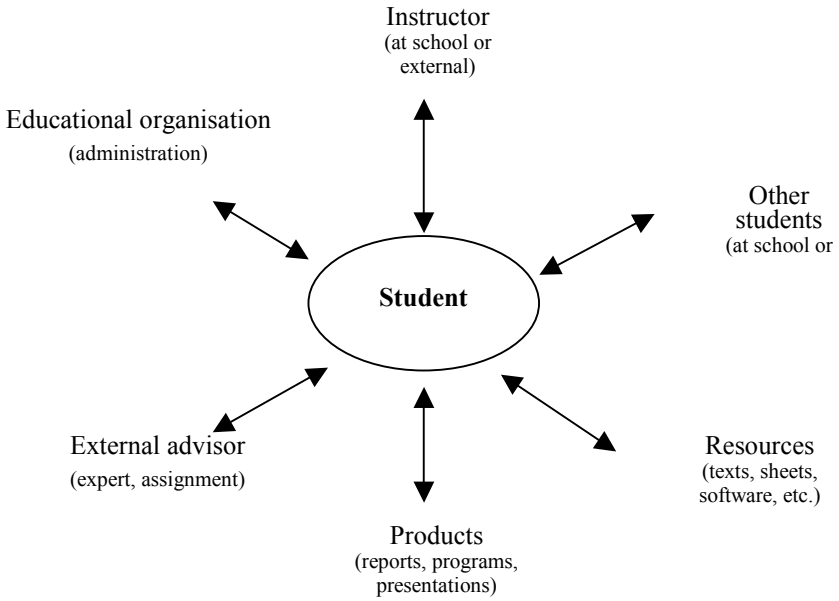

Figure 2 Interactions between student and learning environment
(adapted from Sysling and van Veen (1997)

In this model the student is the most important person in a learning process. According to Sysling and Van Veen the student has several possibilities to start an interaction with his environment: he can study learning materials, receive assignments from the instructor, look for information in a library, discuss the material with fellow students, among various possibilities. In turn, the environment can have interactions with the student: the instructor gives instructions and feedback, students work together on an assignment, the organisation keeps track of study progress, etc. All these interactions relate well to the didactical approaches of self-directed learning and scaffolding.

Sysling and Van Veen claim that for each interaction shown in Figure 2 ICT can be used. Sysling and Van Veen also claim that this kind of education, in which the student is the central focus point and in which ICT is integrated in education, offers sufficient possibilities for interaction and with that with real learning. This can offer added value for students.

3.4.4 Institutional conditions

Institutional conditions are all the conditions that are needed at the level of the institution to implement and integrate ICT in teaching and learning. Funding and costs (Section 3.4.5) and the availability of facilities and technology (Section 3.4.6) are two issues that will be described in greater detail. Another issue are the conditions that is needed at a high level in a university to promote implementation of ICT throughout the whole of the university: vision and broad participation. The organisation in which ICT is implemented has to share a

vision (see for instance Deepwell and Syson, 1999). The vision is needed to change the culture of learning and teaching, to overcome anxieties and to obtain participation of others.

Broad participation of not only the administration (management), but also from instructors (groups or individuals) is one of the most important success factors for implementing ICT in education. The decision to bring about a change such as this needs to be supported by the people who have to implement these changes or who have to cope with the consequences, or as Jaffee (1998) puts it, in order for institutions of higher education to undergo significant transformation, changes must be approved, accepted, and ultimately put into practice by the teaching faculty. Tuinman (1995) argues that one of the fundamental conditions which will have an impact on the probability of success of change is that it is necessary to convince people to co-operate. Changing is not something that the average member of an organisation wants to do, often because of time factors and personal reasons to resist change such as the reluctance to change beliefs and common-used practices. Involvement and the process of becoming aware of the possibilities will help to increase the success.

Farrell (1999) also argues that effective incorporation of new technologies requires a commitment by all parts of an institution. This includes encouraging and supporting initiatives of faculty members, and ensuring that ICT is linked with educational planning. Policy, legislative and regulatory incentives can be used to achieve this. For example, one way to gain the co-operation of others is having an effective leader, someone who can guide and steer the change process. Leadership is not only needed at the top of the organisation, by at every level of the institution. Vice-chancellors or Rectors, Deans and heads of Departments are examples of potential persons who can provide effective leadership during a change. Cameron and Ulrich (1986) describe a kind of leadership, transformational leadership, that according to them will be required in higher education to adapt to changes in the environment. Transformational leadership involves a process of fundamental change. The leader's goal is to help people to think differently about the problems they face and to help them with creating solutions for those problems. Tuinman (1995) claims that access to a leader is probably as important or more so than a leader with great vision.

Other conditions that can play a role in starting to use ICT in education are a changing organisational structure (Bates, 1997) leading for instance to improved access to education (Bates, 1996) and existing, concrete plans at the university or faculty level (Winship, 1996).

According to Deepwell and Syson (1999) the implementation of an institution-wide implementation of ICT, central support services are needed to effect the change. Examples of central support services are technical maintenance and development and staff development groups (see also Section 3.4.6). In addition to this Deepwell and Syson argue that procedures within the organisation have to be simplified. Decisions from the top of the University (for example about the choice of a platform that will be used and supported throughout the university) have to be communicated to everyone involved. By making a specific decision about the implementation of ICT time and effort will be saved.

3.4.5 Cost reduction / Cost-effectiveness

When a university considers starting to use a new form of ICT in education, there must be a clear reason for such an action. As universities are market-oriented, two interconnected reasons can be decisive in this respect. On the one hand, universities may want to introduce

ICT in order to reduce some costs, in particular the transportation and accommodation costs of potential students. On the other hand infrastructural and maintenance costs of the university will rise. It is clear that eventually the extra costs of the university will have to be covered by the cost benefits of having a larger enrolment of students (Fisser, Moonen, Clar, & van Muylwijk, 1997).

Many authors analysed the costs of using new forms of ICT in education during the last decade. Curran (1994); the European Association of Distance Teaching Universities (1993); Bates (1995); Taylor and White (1991); Jones and Simonson (1993); Moonen (1995, 1999, 2000); the Danish Ministry of Education (1993) and many others have published studies concerning the costs of distance education. Some general remarks can be made. Moreover there are many conceptual problems to be taken account of.

When planning to introduce a new form of ICT in education a large portion of the expenses are start-up costs, which in effect, can be the equivalent of five years worth of instructor costs (Jones & Simonson, 1993). Bates (1995) points out that the yearly recurrent cost often exceeds the total start-up capital cost. In general, the recurrent costs of producing good quality technology-based materials tend to be underestimated. Taylor and White (1991) state the philosophy that approximately equal budget allocations should be made to the teaching of all students notwithstanding whether they are taught in an on- of off-campus mode. They further use the policy that if economies of scale accrue through teaching in the distance education mode, the philosophy is that these savings provide the opportunity for up-grading this particular mode of delivery.

Bates (1995) reports that for telelearning delivered as computer-mediated communication, 50 to 60% of the costs can be allocated to personnel costs. Given the fact that the costs of hardware and telecommunications are continually decreasing, the personnel costs as a category in the cost picture of telelearning will gradually become dominant. In all modes of telelearning a critical dimension is the amount of contact that is allowed between the individual student and other persons (instructor, instructor, tutor, other students) in the course. Active members in electronic networks receive an average of 30-100 messages per day. Very soon the extra time necessary to deal with masses of messages become unmanageable.

When considering the implementation of a new form of ICT in education, the effects as well as the costs are important (Moonen, 1999, 2000). Effects relate to benefits (in monetary terms) and/or to effects (in non-monetary terms). The question is how to measure effectiveness. When effectiveness cannot be defined in monetary terms, other quantifiable issues must be measured, for instance the number of graduates, number of graduates placed in appropriate jobs and test scores. A consideration of the effectiveness of ICT involves an assessment of the impact on learning. One question is the extent to which relevant technologies support and enhance learning. Many literature studies show that there are no significant differences in course effectiveness and in student performance when using new forms of ICT. For instance, Moore and Kearsley (1996) conclude in general about distance learning versus face-to-face learning that there are no significant differences between learning in the two different environments, regardless of the nature of the content, the educational level of the students, or the media involved. They think that it is reasonable to

conclude that instruction at a distance can be as effective in bringing about learning as classroom instruction.

Much research has been done in this area, in particular using meta-analysis techniques, to relate the use of media-based learning to achievement, the most commonly used output variable. Depending on the kind of the media-based intervention, the effects vary from positive to undetermined (many references). Russell (2000) mentioned 218 reports about the "no-difference" effect of using media on learning, and put forward questions about why ICT should make a difference. Collis (1993) overviewed more than 400 articles on the use of telelearning in education and concluded then that 'there is no strong expectation of substantial educational impact from telecommunications use', at least no specific data about such impact were available. As a general conclusion it seems reasonable to assume that student achievement will, at least, remain equal when using media to support education and training, and there is no reason why such a conclusion should not be formulated with respect to telelearning (Fisser, Moonen, Clar, & van Muylwijk, 1997). From these studies it appears that a technology can be effective, if it is designed in such a way that the user can deal with it. Or, as Bates (1984) indicated that a well-designed television programme is more likely to be effective than a poorly designed book, while a poorly designed television programme will be far less effective than a well-designed lecture.

An other perspective with regard to costs relates to the accountability as described in Section 1.1.3 or what Massy (1996) calls 'value for money'. Parents' and students' financial worries and rising levels of educational debt are concerns about value for money. According to Massy, the value of education being rewarded by the marketplace shows little tolerance for inefficient of indifferent service, and the market pays little attention to traditional scholarly pursuits. Massy also claims that the concerns about the price of education are not unfounded; in universities the expenditures per full-time student are still growing (Massy, 1996).

3.4.6 Support facilities

For ICT to be used properly in education, a high standard of support facilities is needed. Providing computers and in-servicing staff is not enough to get instructors and students using technology for teaching and learning. Hoffman (1996) has categorised the following success factors to help the process of adopting ICT in education: (a) administrative support; (b) staff development (educational support) and technical support; (c) availability of technology; (d) technology use plan; (e) technology coordinator; (f) facilities and maintenance; (g) assessment and (h) broad participation.

Administrative support is needed for a successful implementation of ICT in education (Bloemen et al., 1999). Administrators can provide the conditions that are needed, such as faculty-wide policy, incentives and resources. For the implementation of an institution-wide implementation of ICT to be successful, central support services are needed to effect the change (Deepwell & Syson, 1999). Staff development is needed to help instructors to use ICT in education such as training and workshops are needed not only to improve the skills of the instructors, but it is also a means of getting them involved in the process of implementing and integrating ICT in teaching and learning. Farrell (1999) argues that it is important to ensure that appropriate staff training and development programmes are

available as an essential part of any change strategy. The application of ICT in education should be shown to enhance existing teaching practice.

Technology (computers, software and teaching and learning applications) should be available to all instructors and students. There should be enough facilities and sufficient access to these facilities. It is recommendable to have a senior coordinator for the technology issues, a person who can be reached easily by instructors and students. The maintenance of the facilities is an other important factor that should not be ignored. Inadequate facilities, slow support and repairs are unfavourable issues for the implementation and integration of ICT in education. To assure continued enthusiasm and support for ICT the technology should be assessed from time to time, in order to be assured of the best technologies for the given situation.

3.5 Summary related to ICT in education

Looking back at Chapters 2 and 3 the statement of Baldridge and Deal (1983) that the most stable fact about organisations, including schools and colleges, is that they change, seems to be accurate. This is also true in relation to using new forms of ICT in education. The factors found in this chapter indicate that there are many aspects that have to be accounted for when a university decides to adopt new forms of ICT in education. From the results of the previous sections in relation to what has been said in Chapters 1 and 2 about change and organisational change it can be said that using new forms of ICT in education can be regarded as a change process.

With this in mind this chapter is concluded. A definition of ICT was given in Section 3.1 in which was indicated that ICT in education means using all kinds of information and communication technologies to make connections among persons and resources that can be used to support the teaching and learning process. Several organisational approaches for the use of new forms of ICT in education, such as telelearning have been identified in Section 3.2 and new forms of ICT have been discussed in Section 3.3. The question of why universities of faculties use ICT in education was addressed and factors that have an influence on using a new form of ICT, including environmental pressures, technology developments, educational developments, institutional conditions, and issues related to costs and support were described in Section 3.4 and are summarised in Table 7:

Table 7 Summary of factors that effect using new forms of ICT in education

Category	Factors	
Environmental pressures	New market	Competition
	Education as business	Response to threats and opportunities
	Part-time students	
	Lifelong learning	Flexibility
	On-demand training	Knowledge management
	Funding	Changing student demographics
	Partnerships	
	Tailor-made products	Demands from employers
	Dynamic environment	Demands from learners
Technology developments	Emerging technology	New technology (push, hype)
	Dependence on IT	
Institutional conditions	New organisational structure	Concrete plans
	Broad participation	Improved access to education
	Shared vision	Leadership
Educational developments	New conceptions of learning	Individual differences
	New teaching models	Active learning
	Focus on learner/learning	
Cost reduction / Cost-effectiveness	Reducing costs	Benefits
	Cost-effectiveness	
Support facilities	Administrative support	Availability technology
	Educational and technical support (including staff development)	Availability facilities

The results from this chapter suggest that there are factors that can influence the decision of a university to adopt some new form of ICT in education. With this statement and with the summary of the factors in Table 7, Research Question 4 *Which factors have an effect on the decision to adopt or support a specific form of ICT in education at a particular university* is answered. With these factors and the five organisational change questions with regard to the organisation change theories as described in Chapter 2, Section 2.4, the next task is to combine these. This is described in the next chapter.

4 Combining organisational change theories and ICT factors

In this chapter the aspects that were discussed in Chapter 2 concerning organisational change theories, and the factors as described in Chapter 3 that could be important in the decision of a university to use new forms of ICT in education are combined. This chapter starts with a combination of the ICT factors and the organisational change factors in Section 4.1. In Section 4.2 this combination is related to the research questions and in Section 4.3 an overview of the case study in which the research questions are examined is given.

4.1 Combining the five organisational change questions and the ICT factors

As described in Chapters 1 and 2 much of the current literature on organisational change in higher education is driven by the perception that a university as an organisation is presently facing an unprecedented range of external pressures that include the changing role of the government, the internationalisation and globalisation of education, changing student demographics and demands, emerging informational and instructional technologies, new skill demands from private sector employers, and new conceptions of teaching and learning.

In Chapter 2 five questions were described that are of importance when an organisation decides which strategic response is the most appropriate in a given situation. These questions deal with the cause, constituents, content, control and context of a change (see Section 2.4.3, Table 3). The five organisationally-oriented questions are adapted to fit the research in this dissertation as follows:

1. Does the university perceived itself as being pressured to use new forms of ICT in education? And if so, Why? (the cause of change)
2. Who is exerting this pressure on the university? (the constituents of change)
3. To what norms or requirements in relation to new forms of ICT in education is the university being pressured to conform? (the content of change)
4. How or by what means are the institutional pressures in relation to using new forms of ICT in education being exerted? (the control of change)
5. What is the environmental context in relation to new forms of ICT in education within which institutional pressures are being exerted? (the context of change)

These five questions will be further referred to as “organisational change questions” or briefly “OC questions”.

In Chapter 3 a number of factors were identified that can have an influence on using or implementing new forms of ICT in education as well as some factors that effect change processes related to ICT. The ICT factors were categorised in six categories (environmental pressures, technology developments, educational developments, institutional conditions, cost reduction, and support facilities). Based on the what has been described in Chapters 2 and 3 a combination of the organisational change factors and the ICT factors can be made.

The five OC questions can be seen as the questions that should be asked if a change in an organisation occurs. The ICT factors assembled in six categories can be used to find responses or determinants for these questions. For instance, looking at the first OC question, it can be predicted that the university perceives itself as being pressured to use new forms of ICT in education because of environmental pressures, such as the increasing demand for lifelong learning and flexible approaches to teaching and learning. But it can also be the case that a university is influenced by cost-related issues in that the university expects that the use of new forms of ICT in education results in a more cost-effective approach for teaching and learning. Also, the university may assume that the possibilities of the new technologies can support new educational approaches, such as focussing on the learner, accounting for individual differences of the learners or promoting active learning. These are only assumptions and have to be examined in this study. At this moment it is possible to say that the five OC questions and their possible determinants related to the six categories of ICT factors will be used as basis for examining the research questions as presented in Chapter 1. This is discussed in the next section.

4.2 Relating the organisational change questions and the ICT factors to the research questions

The overall research question was formulated in Chapter 1 as

"(a) Which factors effect change processes in universities with regard to implementing a new form of ICT in education, and (b) what effect does the choice for this form of ICT have on the implementation of ICT in education in the faculties and departments?"

In view of this research question eight research questions came forward, the first two related to organisational change, formulated as

1. How can organisational theories help the understanding of change processes in universities?
2. How can these theories be applied to the decision to implement and integrate new forms of ICT in education?

The answer to Research Question 1 whether organisational theories can help the understanding of change processes in universities was positively answered in Chapter 2. The two organisational change theories that were described (Institutional Theory and Resource Dependence Theory) gave an insight in the way organisations react to changes in their environment and the consequent change process(es) within the organisation itself. To analyse why an organisation, or in this case a university, changes, five OC questions were formulated and adapted in the previous section of this chapter to fit the research of this dissertation.

The answer to Research Question 2 is more complicated. A first partial answer to Research Question 2 was given in Chapter 2. More information was necessary about the different forms of ICT in education that are available and about how ICT could influence particular aspects of a change in an organisation. This was discussed in Chapter 3. The combination of the five OC questions from Chapter 2 and the ICT factors that were found in Chapter 3 answers the second question related to organisational change (how can these theories be

applied to the decision to implement and integrate new forms of ICT in education?). By adapting the five OC questions so that they relate to ICT in education and by using the ICT factors as potential determinants to the OC questions the two theories provide the basis for examining the other six research questions (Research Questions 3 to 8) in the remainder of this study.

The Research Questions 3 and 4, formulated as

3. What are major forms of ICT use in universities?
4. Which factors have an effect on the decision to adopt or support a specific form of ICT in education at a particular university?

are related to the first part of the overall research question, concerning factors that effect change processes in universities with regard to implementing a new form of ICT in education. A first answer to these two questions was provided in Chapter 3, based on a literature review on new forms of ICT in education. A more comprehensive examination of these questions, based on actual implementation of ICT in education at several universities, will be described in the next chapters. For that purpose the OC questions will be used, especially the OC Questions 1 and 5, relating to the cause and the context of the university and OC Question 3, relating to the norms or requirements of new forms of ICT.

Four additional research questions were formulated in Chapter 1 in relation to the second part of the research question, with regard to the effect that the choice for a new form of ICT has on the implementation of ICT in education in the faculties and departments of a university. These questions have not been answered in the previous chapters, and will be the subjects of research in the case studies as described in the next chapters. Questions 5 to 8 were formulated as:

5. What are the key variables in profiles of universities that follow alternative ways to support ICT in education?
6. What effect does the choice of a specific form of ICT have on the implementation of this form in the faculties and departments?
7. Which forms of ICT are actually implemented in the faculties and departments?
8. What conditions influence the implementation of these forms of ICT in different educational settings?

Again, these four research questions will be answered in Chapters 5 to 8 by using the five OC questions. Research Questions 5 and 8 relate to all OC questions, Research Question 6 to OC Questions 2 (constituents), 3 (content) and 4 (control), Research Question 7 to OC Questions 3 (content) and 4 (control). The combination of the research questions and the OC questions and the way to examine these questions in case studies is described in the next section.

4.3 Overview of the case studies

The research questions (and the OC questions related to them) are answered by carrying out several case studies. First an explorative literature study is conducted, for a preliminary verification of the results from Chapters 2 and 3. The results of the literature study, in which

35 articles are analysed, form the basis for the design of a test case study in a real university context at the George Washington University, described in Chapter 6. The results of the test case study are used for the design of on-site case studies at four universities (the University of Twente, the K.U. Leuven, the Helsinki University of Technology and Lund University) within a network of universities (EUNITE). The four case studies will be carried out separately and later combined into one overall case study. This is presented in Table 8, in which the case study at the George Washington University is absent, because of its nature as a test case.

Table 8 Overview of Research Questions 3-8 in relation to the organisational change questions and the case studies

Research Question	OC Question	Case study	Chapter
3. Which factors have an effect on the decision to adopt or support a specific form of ICT in education at a particular university?	1, 3, 5	Literature study Individual on-site case studies EUNITE cross-site case study	5 7 8
4. What are major forms of ICT use in universities	1, 3, 5	Individual on-site case studies EUNITE cross-site case study	7 8
5. What are the key variables in profiles of universities that follow alternative ways to support ICT in education?	1, 2, 3, 4, 5	Literature study Individual on-site case studies EUNITE cross-site case study	5 7 8
6. What effect does the choice of a specific form of ICT have on the implementation of this form in the faculties and departments?	2, 3, 4	Individual on-site case studies EUNITE cross-site case study	7 8
7. Which forms of ICT are actually implemented in the faculties and departments?	3, 4	Individual on-site case studies EUNITE cross-site case study	7 8
8. What conditions influence the implementation of these forms of ICT in different educational settings?	1, 2, 3, 4, 5	Individual on-site case studies EUNITE cross-site case study	7 8

Each of the chapters will describe the design and the results of the studies described in it, including the answers to the research and organisational change questions related to those studies. In the final chapter, Chapter 9, the answers and conclusions will be combined in a conclusion to the overall research question.

5 Cases from the literature

In this chapter an explorative literature study is described. The literature study has as its goal a preliminary verification of the results from Chapters 2, 3 and 4. The results of this study are the basis for the design of a test case study in a real university context at the George Washington University, described in Chapter 6. This chapter starts with a general introduction into the literature study in Section 5.1. In Section 5.2 the design of the literature study will be described. Section 5.3 discusses the results of the literature study and the answer to Research Question 4 related to the factors that have an influence on the decision to us specific new form of ICT in education. In Section 5.4 four profiles that describe the reasons for universities to use ICT in education are formulated, thereby answering Research Question 5 related to and to key variables in profiles of universities that follow alternative ways to support ICT in education. Section 5.5 presents the conclusions of Chapter 5.

5.1 Introduction

To address the overall research question and the sub Research Questions 4 and 5, a literature study was conducted, using a comparative method. Such a method of analysis focuses on several objects of study, in this case faculties, departments and universities in order to identify similarities and differences (Yin, 1994).

The goal of the literature study is to obtain feedback on the ICT factors found in Chapter 2 and to find preliminary answers to the five questions related to organisational change as formulated in Chapter 4 and to refine and redefine (if proven necessary) the organisational change factors and the ICT factors that could have an influence on the decision to use ICT in education and on the actual implementation of ICT in faculties of a university.

The results of the literature study are expressed in terms of both qualitative and quantitative data. The qualitative data are used for the description of the context and as background information. The quantitative data are statistically analysed. In addition to more general ways of analysing data such as means and frequency tables, cross-tab analysis is also used. The main result of the case study is a first overview of the answers to the five questions and an overview of the most important factors that could have an influence to start using new forms of ICT in education. The results form the basis for verifying the list of ICT factors and identifying four profiles that describe the reasons for universities to use ICT in education.

5.2 Design of the literature study

This section gives a short overview of the literature study, the research questions, the selection of cases, data gathering and analysis techniques.

5.2.1 Overview of the literature study

The goal of the literature study was to obtain feedback on the factors found in Chapters 2 and 3 and to refine and redefine (if proven necessary) the organisational change factors and

the ICT factors that could have an influence on the decision to use ICT in education and on the actual implementation of ICT in faculties of a university. To accomplish this 35 articles were analysed in two ways. The first method of analysis was by coding each article in terms of one or the other of the two alternative values associated with each of the five OC questions as described in Chapter 4, Section 4.1 (first introduced in Section 2.4.3). The articles were also coded "yes" or "no" on each of the ICT factors as described in Chapter 3, Section3.5.

In Table 9 an overview is given of the variables used in the literature study.

Table 9 Overview of the variables used in the literature study

Variable	Values
The five questions related to organisational change (see Chapter 4, section 4.1):	
Cause	Social fitness *versus* economic fitness
Constituents	Multiplicity of constituent demands *versus* dependence on institutional constituents
Content	Consistency with organisational goals *versus* discretionary constraints imposed on the organisation
Control	Coercion or enforcement *versus* voluntary diffusion of norms
Context	Environmental uncertainty *versus* environmental interconnectedness
The ICT factors (see Chapter 3, Section 3.3.7)	Indicated as important: yes or no

5.2.2 Research questions

The literature study has as goal to find a preliminary answer to the overall research question as formulated in Chapter 1, Section 1.3. To answer this research questions the five OC questions identified in Chapter 4 are used.

5.2.3 Selection of cases

In order to carry out the literature study recent articles about the implementation of ICT in an educational context had to be selected. For that purpose twenty-four papers from two recent conferences related to ICT in education (Teleteaching '98 and Networked Lifelong Learning '98) and 11 papers from a recent special issue journal were selected for analysis. The two conferences (described below) were organised around new and innovative ways of using new forms of ICT in education.

Teleteaching '98 was part of the 15th IFIP World Computer Congress of the International Federation for Information Processing (IFIP). At this congress several sub conferences were held, all related to ICT (Global IT Security, Foundations of Computer Science, Computers and Assistive Technology, Intellectual Property Rights and Free Flow of Information, Distance Learning, Teleteaching: Training and Education, Telecooperation and Informations Technology and Knowledge Systems). At the overall conference about 1200 delegates from 71 countries attended and the state of the art related to ICT was presented (Davies, 1998).

Networked Lifelong Learning '98 was an international conference for instructors, lecturers, trainers and researchers from all sectors to consider the paradigm shift from

traditional to distributed and distance learning using Internet technologies in learning innovation & implementation organised by the University of Sheffield's Centre for the Study of Networked Learning. The conference was designed to bring together managers, instructors, lecturers, trainers and researchers from all sectors in education and training (Banks, Graebner, & McConnell, 1998).

Because of the innovative and international nature of both conferences a selection of the papers presented is chosen to be included in the literature study.

A complete list of papers from both conferences that were used in this literature study can be found in Appendix A. The selection of the conference papers within the two sets of proceedings involved a random selection process. In addition to the conference papers all the articles of the special double issue of the journal Interactive Learning Environments were used (Collis, & Ring, 1999). Since 1990 Interactive Learning Environments has provided an archival repository of research and a forum for all individuals working towards changing education through learner-centred use of information technology. Because the journal broadens its scope to cover technologies such as Internet, groupware and multimedia and their impact on the fields of education and training, life-long learning and sharing knowledge in the global village this journal was chosen for the literature study.

Within each paper or article an "organisation" is defined as the organisational unit that was discussed in the paper or article. In some cases this meant a university as a whole, in other cases a department or a single course. As far as can be observed most authors of the selected papers and articles are instructors and researchers.

5.2.4 Procedure of data gathering and processing

For each literature case the five OC questions as presented in Section 4.1 were coded by choosing between the two possibilities for each dimension as formulated in Table 3. Next, for each paper an indication was made of which categories of ICT factors were likely to have had an influence on the answer to the OC question. The complete scoring form that was used as well as the coding results per article are presented in Appendix B. After this, for each paper the ICT factors (environmental pressures, technology developments, educational developments, institutional conditions, cost reduction, and support facilities) that are indicated in the paper or article as important were scored, using Scoring Form B presented in Appendix C with the results. After scoring all 35 papers and articles the data were combined into one data set. The results are presented in Section 5.3.

5.3 Results of the literature study

In Section 5.3.1 an overview of the results is given. After this the results in relation to organisational change is described in Section 0.

5.3.1 Factors that influence the use of new forms of ICT

An overview of the factors that influence the use of new forms of ICT in education as extracted from the 35 cases is given in Table 10. This table is based on the results of Section 3.3 and Appendix C. A more detailed description follows after the table.

Table 10 Total overview of ICT factors, 35 cases

Category of ICT factors	ICT Factors	Number of times the factor has been indicated as important(n=35)
Environmental pressures	New market	11
	Education as business	1
	Part-time students	7
	Lifelong learning	14
	On-demand training	2
	Funding	15
	Partnerships	13
	Tailor-made products	2
	Dynamic environment	0
	Competition	7
	Response to threats and opportunities	2
	Flexibility	24
	Knowledge management	0
	Changing student demographics	15
	Demands from employers	5
	Demands from learners	11
Technology developments	Emerging technology	20
	Dependence on IT	2
	New technology (push, hype)	30
Institutional conditions	New organisational structure	7
	Broad participation	13
	Shared vision	4
	Concrete plans	12
	Improved access to education	10
	Leadership	10
Educational developments	New conceptions of learning	23
	New teaching models	29
	Focus on learner/learning	19
	Individual differences	3
	Active learning	11
Cost reduction / Cost-effectiveness	Reducing costs	10
	Cost-effectiveness	11
	Benefits	2
Support facilities	Administrative support	9
	Educational and technical support	18
	Availability technology	27
	Availability facilities	26

Based on the results from Table 10 the following observations can be made:

Environmental Pressures
Almost all authors of the analysed papers recognised that their organisation is influenced by factors from the category Environmental Pressures. There are only two papers which have no indication in them that they are not influenced by environmental pressures. The factor "flexibility" within the category environmental pressures is identified as the factor that most authors (24) indicated as important. Flexibility has two attributes in the papers: time and place. Most papers indicate that flexibility in place is more important than flexibility in time.

Other environmental factors that are identified frequently (10 or more) as a cause for using new forms of ICT in education are (in order of number of times mentioned) funding, changing student demographics, lifelong learning, partnerships, new market and demands from learners. Factors that are not mentioned at all in the papers are the influence of the dynamic environment of the organisational unit and knowledge management. This is probably due to the fact that a combination of other variables can be interpreted as contributing to a dynamic environment.

Technology developments
Technology developments as a reason for using new forms of ICT in education is mentioned by all authors except one. This could mean that the developments in relation to technology that can be used in education seem to be an important influence on the actual use of ICT for education-related purposes. From the papers and articles the factors “emerging technology” and the “push and hype for using new technology” are prominently present. There are however only two authors who say that universities are becoming more and more dependent on technology.

Institutional conditions
Institutional conditions appear to account for not much of the reasons for universities to use ICT in education, if they are compared with the other five categories. But, within this category the most important factors when introducing ICT in education in these cases are broad participation, concrete plans, improved access to education, and leadership. Broad participation from all persons involved in setting up ICT in education seems to be very important. Instructors, students, management, and support persons are mentioned as being important to include in the process. The general feeling is that without the involvement the implementation process would be more difficult (or not possible). Together with broad participation, having concrete plans appears to be important. In most cases there is a project plan with specific deliverables or outcomes. The plans are shared with the people involved and it seems that they are also used to involve others who are (not yet) using new forms of ICT in education.

The universities described in the papers and articles use ICT to offer improved access to education (n=10). Leadership on this point seems to be a factor that is a condition for reaching this improved access (n=10). Looking at the factors above it is surprising that “shared vision” could only be found in four of the papers and articles. Maybe some of the authors believe that broad participation can be seen as having a shared vision? This needs more research.

Educational developments
Recent educational developments are having a major influence on the use of new forms of ICT in education. New conceptions of learning, new teaching models and a focus on the learner instead of the instructor appear to be especially important. Almost all articles describe the idea that there is a shift from instructor-centred to learner-centred education. A commonly used phrase is “from the sage on the stage to the guide on the side”. In addition to this active learning is frequently mentioned. It is remarkable that accounting for individual differences’ is not a specific reason to use ICT in education in these cases. Only three authors mentioned this factor.

Cost reduction / Cost-effectiveness
The general feeling in the papers and articles is that using new forms of ICT will or should reduce the costs of education and that cost-effectiveness (however defined) is important. However, there are only two authors who expect financial benefits from the use of new forms of ICT (in the form of more students).

Support facilities
Support facilities are significant factors that should be present within the organisation. Without support, whether it is technical or personal, implementing ICT will not be possible.

Summarising the most important factors results in Table 11.

Table 11 ICT Factors, mentioned in at least 66% of the articles

ICT Factors, mentioned in at least 66% of the articles	Number of times the factor has been indicated as important(n=35)
New technology (push, hype)	30
New teaching models	29
Availability technology	27
Availability facilities	26
Flexibility	24
New conceptions of learning	23

5.3.2 Organisational change

As an extension to the literature study the five OC questions with the scoring on the alternatives to each dimension as described in Chapter 4, Section 4.2 were used to code the articles. The results from Appendix B are presented in Figure 3 and described after the figure.

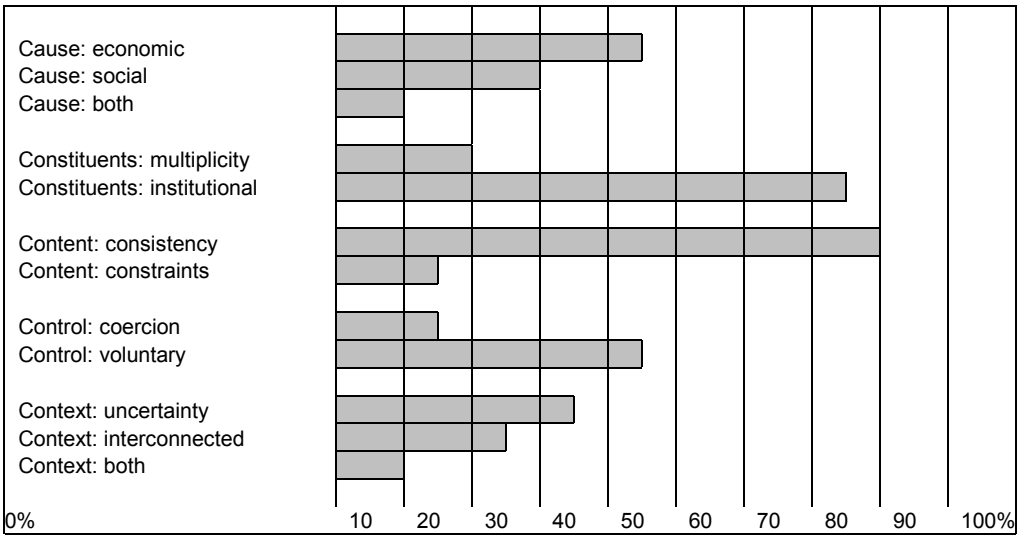

Figure 3 Results on the five organisational change questions related to organisational change, choice of dimension alternatives

From Figure 3 the following observations can be made:

The cause of the change
The first question of the five questions related to Oliver's dimensions was "Why is the organisation being pressured to conform to institutional rules or expectations? With this question the cause of the change is determined. In this case the more specific question was " Does the university perceive itself as being pressured to use ICT in education? And if so, why?". According to Oliver (1991) two general answers are possible. Organisations change because of legitimacy or because of efficiency. Legitimacy can be explained as social fitness and efficiency as economic fitness. From the 35 papers and articles that are analysed there are 19 cases that indicated that social fitness played a role in using new forms of ICT in education. Eleven papers/articles indicated that economic reasons played a role in the decision to use ICT in education (the total is not equal to 35, because in several papers both reasons were given, n=4, and in one case no answer could be determined).

The constituents of the change
The second of the five questions is "Who is exerting institutional pressure on the organisation?" (the constituents of the change). According to Oliver (1991) two general answers are possible in relation to the constituents of the change: multiplicity of constituent demands or dependence on institutional constituents.
In the papers and articles a distinctive distribution can be seen. Most of the constituents or persons involved are inside the organisation. Specific cases in which the constituents are outside the organisation involved a project with external partners. Of the 35 papers and articles, in 27 it could be indicated that the constituents consisted of persons within the organisation. Only seven authors indicated that external constituents are involved.

The content of the change
The third OC question in this research is "To what norms or requirements is the organisation being pressured to conform?" (the content of the change). Values for the dimensions are the consistency with organisational goals and discretionary constrains imposed on the organisation. Again, there is a strong division.

From the papers and articles it is evident in 28 of the cases that the content of the change is consistent with organisational goals. From six others there were some constraints imposed on the organisation. In most cases this involved (again) a project with external partners.

The control of the change
The fourth question is "How or by what means are the institutional pressures being exerted?" (the control of the change). For the control of the change the values of the dimension are legal coercion or enforcement, and voluntary diffusion of norms. From analysing the papers and articles the voluntary implementation of ICT in education was mentioned most (n=15). There were only 6 instances in which it could be deducted that some form of enforcement was used.

This question is the most difficult to find the answers in the papers and articles. For 14 papers and articles it was not possible to identify either of the values of the dimension. It seems as if this dimension needs further clarification.

The context of the change
The last OC question is "What is the environmental context within which institutional pressures are being exerted?" (the context of the change). The values for this dimension are environmental uncertainty and environmental interconnectedness.

From the papers and articles a small distinction can be made. Thirteen authors indicated that the organisation in which ICT is implemented have to react to an uncertain environment. In general, this is related to changing groups of students and emerging technology. Sixteen authors indicated that their implementation of ICT in education takes place in an interconnected environment. This can be explained by the kind of ICT implementation. This dimension has a different influence on the implementation of ICT in a course compared to the implementation of ICT at the university or in a network of universities. This is object of more research in the future.

From these results in relation to organisational change it can be seen that in the OC questions regarding constituents, content and control, the answers indicated an obvious 'preference' to one of the alternative values (institutional, consistency and voluntary). Because of the obvious preference these three questions are not further studied here. The other two (related to cause and context) will be the focus at this moment, to see if the distribution of the answers can explain some of the results described in this chapter. In the chapters describing the on-site case studies the focus is again on all five questions.

The most interesting dimensions are those related to the cause and the context of the change, because the first issue asks about the reasons for using new forms of ICT in education and has therefore a direct impact on the answer to the overall research question. The question related to the context of the change is interesting because the results show a smooth distribution of the answers, in other words, the authors of the articles do not agree with each other. An interesting aspect is that these two issues of cause and context are also the two categories that are described in Chapter 2 in relation to the convergent and divergent assumptions of Resource Dependency Theory and Institutional Theory: the *context* of organisational behaviour and the *motives* of organisational behaviour. These two dimensions of organisational change, cause and context, are further analysed based on the data from the literature study and described in the next section.

5.4 Profiles of universities in change processes involving ICT

This section describes the construction of four possible profiles of universities that are involved in a change process related to using a new form of ICT. The construction is accomplished by:

- constructing a cross-tab analysis of the bipolar values for the cause and the context of the change dimensions and identifying cells that can be used for further examination (Section 5.4.1);
- naming the identified cells according to their place in the table and thereby suggesting four possible profiles of universities that are involved in a change process related to using a new form of ICT (Section 5.4.2);
- identifying which of the ICT factors fit in these specific profiles (Section 5.4.3);
- describing the profiles by using the distinguishing ICT factors (Section 5.4.4).

The results of these steps can be described as follows:

5.4.1 Cross-tab analysis, cause and context dimension alternatives

By constructing cross-tab tables of the bipolar values for the cause and the context of the change dimensions (using new forms of ICT in education) an attempt is made to find relationships among the values. Table 12 shows the cross-tab table. The relationship between cause and context is significant (Pearson Chi-Square = .027, 2-sided, $p < 0.05$).

Table 12 Cross-tab analysis cause and context and significance (n=26)

		Context	
		Uncertainty	Interconnected
Cause	Social	3	12
	Economic	7	4

NB: For 9 out of the 35 articles it was not possible to categorise them into one of the dimension alternatives, they are left out of the further calculations.

5.4.2 Naming the cells

Figure 4 shows the simplified view of the four cells. Each cell has been given a name, based on the quadrant in which the cell is placed.

	Uncertain context	Interconnected context
Social cause	**Profile 1: Supporting learners in a changing world (n=3)**	**Profile 2: Developing expertise in the institution (n=12)**
Economic cause	**Profile 3: Surviving in a competitive world (n=7)**	**Profile 4: evolving to a cost-effective approach in education (n=4)**

Figure 4 The four profiles

In this way Figure 4 helps to distinguish four profiles of universities involved in a change process of using new forms of ICT based on 26 cases in the literature. ICT factors that fit in the specific profiles are identified in Section 5.4.3. After this the profiles are described in Section 5.4.4.

5.4.3 Identifying the ICT factors that fit in the specific profiles

Using the coding of the Scoring Form B it is possible to analyse which of the ICT factors are specifically interesting for each profile. For that purpose Table 13 is constructed in which the factors per profile are presented if they are mentioned as important by at least 50 percent of the articles associated with that profile.

Table 13 Factors that fit a specific profile

(✔ if 50% or more of the papers fit)

	Profile 1 Supporting learners in a changing world (n=3)	Profile 2 Developing expertise in the university (n=12)	Profile 3 Surviving in a competitive world (n=7)	Profile 4 Evolving to a cost-effective approach in education (4)
Flexibility	✔	✔	✔	✔
New technology (push, hype)	✔	✔	✔	✔
New conceptions of learning	✔	✔	✔	✔
New teaching models	✔	✔	✔	✔
Focus on learner/learning	✔	✔	✔	✔
Availability technology	✔	✔	✔	✔
Availability facilities	✔	✔	✔	✔
Emerging technology	✔	✔		✔
Funding	✔		✔	✔
Educational and technical support	✔		✔	✔
Administrative support	✔			✔
Broad participation		✔	✔	
Concrete plans		✔	✔	
Improved access to education			✔	✔
Reducing costs			✔	✔
Cost-effectiveness			✔	✔
Shared vision		✔		
Active learning		✔		
Lifelong learning			✔	
Changing student demographics			✔	
Demands from learners			✔	
Leadership				✔

From Table 13 it can be seen that there are some ICT factors that fit all four profiles, indicated in the upper grey cells. These factors are flexibility, new technology (push, hype), new conceptions of learning, new teaching models, focus on learner/learning, availability of technology and availability of facilities. In relation to the factors that were found as most important in Section 5.3.1 it can be seen that the factors emerging technology and educational and technical support are the only two factors that were indicated as important in Section 5.3.1 by at least 50% of the articles, but are not included in all four profiles.

It is interesting to see if there are factors that are of importance across some of the profiles. From Table 13 it can be seen that there are factors that fit in 2 or 3 profiles. For example, funding and educational and technical support seem to be important in Profiles 1, 3 and 4. This suggests that in Profile 2, where there are social motives to use new forms of ICT in a certain, interconnected context, budgets for ICT and technical assistance are less important. Table 13 shows that there are also two groups of factors that have an overlap. Broad participation and concrete plans are important in the Profiles 2 and 3, and improved access to education, reducing costs and cost-effectiveness are important for Profiles 3 and 4. From

these two observations it can be suggested that both internal institutional conditions and cost-related issues are mostly important for Profile 3 , the profile with an economic motive to use new forms of ICT and an uncertain context, but that the profiles that have a tendency to social motives in a certain environment will put more emphasis on the institutional conditions (even though these are not mentioned often, see Table 10) and the profiles that have a tendency towards economic motives in a certain environment will stress the importance of costs and cost-effectiveness. This is not a surprising answer, but more a confirmation of what could be expected and a very careful verification of the usefulness of the profiles.

Interesting are the factors that fit some or only one specific profile. They are indicated in the lower grey cells and are described in the next section where a description of the four profiles is given.

5.4.4 Description of the profiles

For each of the profiles and the factors that are specifically interesting or characterising for the profiles a description is given:

Profile 1: Supporting learners in a changing world (n=3)
Profile 1 combines social reasons for using a new form of ICT in education and the fact that the environment around the organisation (university, department, etc) is uncertain. In addition to the general issues as mentioned above, funding, emerging technology, educational and technical support and administrative support are important issues in the decision to use a new form of ICT in education. Support for students and instructors and especially administrative support within the organisation is important. These factors are important for a university in order to help and support students to prepare them for a society in which new skills and attitudes are necessary. Because of the new demands that are posed on the organisation, the university's first priority is to investigate what the student of the future needs in his or her prospective working life and how to cope with these needs.

> Example: in view of the renewed interest in a certain Faculty by both regular and part-time (lifelong learning) students, the Faculty felt the need to provide both cohorts of students with the best support possible. Because the part-time students are scattered over the country and because they are not able to follow the everyday lectures, the Faculty developed its own course management system which supports all the students in their learning process. Communication, information and organisational issues are supported by the system.

Profile 2: Developing expertise in the university (n=12)
Profile 2, the profile that seems to be the most frequently matched profile in this literature study, combines social reasons for using new forms of ICT in education and the fact that the environment around the organisation (university, department, etc) is interconnected. Again, the changing profile of the student is important. In addition to the regular student's needs, the needs of other kinds of students become increasingly substantial. A difference to Profile 1 is that in this situation the local environment is interconnected. This means that the university or department knows what is going on in the outside world. This has as consequence that in addition to emerging technology and the idea of active learning other

institutional issues, such as broad participation, concrete plans, and shared vision are important in this profile.

> Example: Department X has been at a presentation of Department Y's experiences in using Web-based environments in education. Because Department X is facing the same challenges in relation to supporting students in their learning process, they are interested in the approach of Department Y. They will use the existing experiences to develop their own courses with ICT. By doing this they know what to expect from this kind of use of ICT in education and they have the possibility to support their students in a better way.

Profile 3: Surviving in a competitive world (n=7)
Profile 3 combines economic reasons for using new forms of ICT in education and the fact that the environment around the organisation (university, department, etc) is uncertain. The organisation has to deal with changing demands from society such as the need for lifelong learning and with diminished funding. In order to generate more financial income the university or department has to find new resources such as new (and more) students and money from business and industry for research & development. Every year the same effort to generate income is carried out, in order to get some degree of financial independence to carry out the primary activities. Concrete plans and broad participation seem to be important aspects.

> Example: Current student numbers are dropping. The competition with other universities is high. To attract more students to the university, the management decides to seek new markets. Several business and industry partners have indicated that they would be interested in continuing education opportunities for their employees, but there must be some kind of place-flexibility, because they do not want their employees to be away from their working place. The universities expect that they can ask high fees for these new kinds of students and start to offer continuing professional courses at a distance. Students can contact the instructors by telephone and e-mail. In addition to this they have discussions via a discussion group at the Internet.

Profile 4: Evolving to a cost-effective approach in education (n=4)
Profile 4 combines economic reasons for using new forms of ICT in education and the fact that the environment around the organisation (university, department, etc) is interconnected. Decreases in funding, the fast developments in technology and the demand for improved access to education cause universities to rethink their expenditures. They realise that they cannot do it on their own and have to find partnerships with other universities and industry to know what is going on in the world. By doing this they can offer the services that are needed and gain financial benefit. Administrative support is important. A difference from the other profiles is that the factor "leadership" seems to be of major influence on the decision to use a new form of ICT in education.

> Example: Two universities offer the same programme to their students and decide that it is more cost-effective if only one instructor at university A will give the course. This means that the students from both universities follow the lecture given at only one of them. The students from university B do not have to travel to the other university, they can attend the lectures by using videoconferencing and a Web-based course

environment. This saves design and development costs for the lectures and it save time and travel costs for the students.

5.5 Conclusion

From the literature research as described above it can be concluded that the six categories of factors (environmental pressures, technology developments, educational developments, institutional conditions, cost reduction, and support facilities) contain the factors that are the most important in the decision of a university (or department) to start using a new form of ICT in education. Factors that are of major importance are the constant development of new technology, new ideas of offering education to students and the belief that the implementation of ICT has to be supported by sufficient support facilities. This suggests that there is a technology push involved in the decision to using a new form of ICT, accompanied by the idea that ICT can help to change the teaching and learning process with a shift in focus from the instructor to the student. From the results of this literature study it cannot be deducted whether the technology push or the educational ideas are the leading motive for using new forms of ICT, but the organisational change topics give some assistance in this matter.

Looking at specific organisational change issues, it appears that there are universities or departments that start using new forms of ICT for social reasons, and some for economic reasons. Most of the persons involved in using or starting to use ICT are persons from within their own organisation. Some external persons are involved if it comprises a project with other partners. The change to using new forms of ICT in education is in general consistent with the existing goals of the organisation and the implementation is in general voluntary. While almost half of the organisations feel that they are part of an environment that is uncertain, the others assume organisational stability. Furthermore these results suggest that the implementation of new forms of ICT is not (yet) integrated in the present teaching and learning practice: from the analysis of the articles it can be seen that most projects that are described are at the level of individual or small group initiatives, to some extent supported with budgets and facilities. This is probably due to the fact that most papers and articles are written by instructors and researchers, innovators who are interested in using new forms of ICT in education. However, from the results it appeared the way education is designed and delivered has not changed much compared to the more traditional ways of teaching and learning (lectures, workshops, exams). Complete integration of ICT in teaching and learning was not observed in the articles. In the on-site case studies this will be further examined with in-depth interviews.

In this literature study it was possible to generate four possible profiles of a university in which specific factors were identified as important. In the profiles emerging from this research the focus was on those situations in which the cause of using new forms of ICT in education is social or economic. This was combined with the idea that the environment in which this is happening can be either uncertain or interconnected. This led to the development of four profiles. Regardless of which profile is applicable to a university the university is influenced by ICT factors. The ICT factors that are of importance for each of the profiles are flexibility, new technology (push, hype), new conceptions of learning, new teaching models, focus on learner/learning, availability technology and availability

facilities. The differences between the profiles was discussed and the results showed that there are specific factors that fit into specific profiles.

The results of this literature study will also be used to make decisions about the methodology of conducting on-site case studies to go more deeply into the research questions. These methodological issues in relation to designing and conducting case studies are described in the next chapter.

6 Case studies: Introduction to the methodology and a test case

In this chapter an introduction to case study methodology is given and the design of the test case study is described. This test case study serves as a preliminary case study in which the selected methodology as described in this chapter is evaluated. Based on this evaluation the following set of case studies will be designed and carried out (see Chapter 7).

This chapter starts with a general introduction into case study methodology and design in Section 6.1. In this section attention is given to various issues, such as single and multiple cases, case study components, collecting data and analysing and presenting data. In Section 6.2 the design of the case study at George Washington University as a test case is described and in Section 6.3 the results of this case study are described including recommendations for further case studies.

6.1 Introduction to case study methodology

To answer the overall research question and the sub Research Questions 4 to 5 and to verify the factors as found in Chapters 2 and 3, five case studies were conducted, one as a pilot or test case study, and then four for comparative analysis. This section gives an overview of the application of case study research, describes the difference between single and multiple cases and between different case study approaches and discusses the issues of equivalence and independence of case studies. Next, the components and the units of analysis of a case study are described and ways to collect and analyse and present the data and the results are discussed. Finally a case study protocol is presented in which guidelines are given which will be tested in a pilot case study.

6.1.1 Application of case study research

A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 1994). Case study research has been applied in the social sciences since the early 1900's and has been used extensively in the field of sociology (Tellis, 1997), but is also used in other fields of research. Yin (1994) presented at least four applications for a case study model:

1. To explain complex causal links in real-life interventions;
2. To describe the real-life context in which the intervention has occurred;
3. To describe the intervention itself;
4. To explore those situations in which the intervention being evaluated has no clear set of outcomes.

It can be argued that the use of new forms of ICT in education involves all four of the above categories. By doing the case studies the relation between the factors that effect change processes in higher education organisations with regard to using some new form of ICT in education, and the effect of the choice to use ICT in education on the actual implementation

of ICT in the education of the faculties and departments will be further described. Thus one of the goals of doing the case studies is to explain (a) the intervention of the factors on the decision makers and (b) the intervention of the choice of the decision maker on the implementation of ICT in education. A description of the real-life context in which the intervention has occurred and the description of the interventions themselves are part of the case studies. It is possible that there are situations in which the two described interventions have no clear set of outcomes. If this is true, this will emerge from the analysis and description of the results of the case studies.

Even though case study research has been (and still is) applied intensely, there are several criticisms that can be made about case study methodology. Construct validity can be problematic in case study research. It has been a source of criticism because of potential investigator subjectivity. Yin (1994) proposed three remedies to counteract this: using multiple sources of evidence, establishing a chain of evidence, and having a draft case study report reviewed by key informants. Using multiple sources of evidence and establishing a chain of evidence are described in Section 6.1.8 about collecting data. Having a draft case study report reviewed by key informants will be accomplished in two ways: (a) by doing a test case study to validate the design and methodology described in this section and (b) by asking the key informants of the various case studies to comment on the draft versions of reports of the case study results.

Some of the criticism against case studies in this area relate to single-case studies. One of the most pertinent comments made is that if a single case study is used, the research will be incapable of providing a generalising conclusion. But in relation to this Hamel, Dufour and Fortin (1993) and Yin (1993, 1994) forcefully argued that the relative size of the sample does not matter. The goal of the study should establish the parameters, and then should be applied to the research. In this way, even a single case could be considered acceptable, provided it met the established objective. Case studies do not need to have a minimum number of cases, or to randomly "select" cases. The researcher needs to analyse and to work with the situation that presents itself in each separate case (Yin, 1994).

This raises some questions about single or multiple case designs and approaches and, in the case of multiple cases, about (in)dependence and equivalence of the case studies. These questions are discussed in the next two sections.

6.1.2 Single or multiple cases

Case studies can use single or multiple case designs, where a multiple design must follow a replication rather than sampling logic. When no other cases are available for replication, the researcher is limited to single case designs (Tellis, 1997). A case study (single or multiple) will contain data, often voluminous, from a multiplicity of sources, such as interviews, field observations, and archival documents, and this data may be incompatible or even contradictory. According to Miles and Huberman (1984) data reduction is part of the analysis process of the case study. It involves not only the selection and focusing of data, but also simplifying, abstracting and transforming the raw data.

Multiple cases will require two stages of analysis, the within-case and the cross-case analysis. In a within-case design each case is treated as a single unit, and the data are analysed within the situation of the case. The cross-case analysis is used to find abstractions

across the cases and is an attempt to understand how processes and outcomes are qualified by local conditions. These processes are described in more detail in Sections 6.1.9 and 6.1.10 on the method of analysis.

Yin (1994) has pointed out that the generalisation of results, from both single and multiple designs, is made to *theory* and not to populations. This means that case studies are not representative of entire populations, nor do they claim to be. Therefore the researcher should take care not to generalise beyond cases similar to the one(s) studied if a theory is used that could be applied differently in other settings. Multiple cases however strengthen the results by replicating the pattern-matching, thus increasing confidence in the robustness of the theory.

6.1.3 Case study approaches

Yin (1993) suggested that there are three case study approaches: exploratory, explanatory an descriptive. In *exploratory* case studies, fieldwork, and data collection may be undertaken prior to definition of the research questions and hypotheses. An *explanatory* case is suitable for doing causal studies. *Descriptive* case studies require that the investigator begins with a descriptive theory. This implies that in this type of study hypotheses of cause-effect relationships are formed.

Another way of looking at case studies, based on the way the data will be used, is to divide the cases into the following categories: descriptive, interpretative and evaluative (Willis, 1998). The purpose of a *descriptive* case study is to provide a rich, detailed description of the case. In contrast to Yin, Willis argues that there is no effort to begin with a theory. Researchers that use an *interpretative* case study use the descriptive data to "develop conceptual categories or to illustrate, support, or challenge theoretical assumptions held prior to the data gathering" (Merriam, 1988, p 28). An educational researcher, for example, might study the pattern of acceptance (and rejection) of technology in a high school to see if the pattern in this school follows the pattern proposed by the Concerns-based Adoption Theory. *Evaluative* cases have all that descriptive and interpretative cases have. To that base they add evaluation or judgement. Evaluative case studies are popular as a means of program evaluation.

Chenail (2000) describes a method for assessing the choice for a specific research method and identifies the 'Seven C's'. Curiosity, Confirmation, Comparison, Changing, Collaborating, Critiquing, and Combinations. Each of the "C's" stands for the kind of relationship between the researcher and the other person(s) involved in the project. Each relationship is connected with a particular research method:

- Curiosity and Qualitative Methods
- Confirmation and Quantitative Methods
- Comparison and Comparative Methods
- Changing and Action Methods
- Collaborating and Collaborative Methods
- Critiquing and Critical Methods
- Combinations and Mixed Methods

In this research about using new forms of ICT in education three C's can be indicated as the most important: curiosity about the subject, confirmation of findings from the literature and comparison of different cases. According to the categorisation by Chenail (2000) the seventh C, combinations with mixed methods (in this case qualitative, quantitative and comparative) seem to fit best in this research. This approach distinguishes itself from the others in that the emphasis is on the integration and possible contradictions of the results. Therefore, in this research the descriptive approach as described by Yin (1993) and the interpretative approach as described by Willis (1998) will be used. Furthermore, the case studies will be comparative and designed as multiple cases.

Designing multiple cases evokes questions about the (in)dependence and equivalence of the separate case studies. This issue is described in the next section.

6.1.4 Equivalence and independence of case studies

A first issue when doing case studies is the problem of equivalence (Van Vught & Goedegebuure, 1994): how it be assured that the objects that are under comparison are the same or equivalent? In this specific research about using new forms of ICT in education universities are selected to be compared. Comparing a university in the Netherlands with universities in other countries in Europe will need some points of comparability in context with regard to using new forms of ICT in education. This is facilitated to a certain level, if universities in a common network of universities are compared. There are a number of networks or co-operations among European universities that have a common goal. Usually the founding institutions have several characteristics in common, but of course there will be many differences as well. Even though this problem is recognised, the work of Yin suggests that case studies do not need to be randomly selected cases, but the researcher needs to analyse and to work with the situation that presents itself in each separate case (Yin, 1994). As stated before in the previous section, the generalisation of results, from both single and multiple designs, is made to theory and not to populations. Multiple cases however strengthen the results by replicating the pattern-matching, thus increasing confidence in the robustness of the theory.

The second problem in the research is what Van Vught and Goedegebuure (1994) call the Galton's problem, which was raised by the statistician Galton (1889) and concerns the question of how much of the characteristics of a specific culture is due to its own autonomous dynamics and how much to diffusion from other cultures. According to Van Vught and Goedegebuure in this case a small number of cases is an advantage, because a small number of cases allow more attention to details and a more thorough analysis of possible interdependencies between cases. Still, identifying universities within a specific network of universities does not guarantee independence. Therefore it is important to consider that according to Yin (1994) the quintessential characteristic of case studies is that they strive towards a holistic understanding of cultural systems of action. Cultural systems of action refer to sets of interrelated activities engaged in by the actors in a social situation. Therefore the results of the separate case studies should be analysed and discussed with the characteristics of the specific university in mind.

6.1.5 Case study components

Yin (1994) recommended the use of a case study protocol as part of a carefully designed research project. This would include an overview of the project (with project objectives and

case study issues), field procedures, questions and a guide for the report. This is described in more detail at the end of this section. Next the case studies have to be designed, carried out and analysed. The analysis of the case study is the critical factor in this research. In relation to this Yin (1994) identified five components of research design that are important for case studies:

1. the study's questions
2. its propositions (if any)
3. its unit(s) of analysis
4. the logic linking of the data to the propositions
5. the criteria for interpreting the findings.

An other approach is presented by Soy (1998), who draws upon the work of Stake (1995), Simons (1980), and Yin (1994). She proposes six steps in conducting case study research:

1. determine and define the research questions,
2. select the cases and determine data gathering and analysis techniques
3. prepare to collect data
4. collect data in the field
5. evaluate and analyse the data
6. prepare the report.

In this research the approaches mentioned above are combined and the design of the case studies are described according to the approaches. In the description of the design of the test case study in this chapter this means that attention will be paid to the research questions, the unit of analysis, the process of data collection, the instrumentation for data collection, the method of quantitative and qualitative data analysis and to presenting the results.

6.1.6 Research questions

The case study has as goal to find an answer to the overall research question: *Which factors effect change processes in universities with regard to using new forms of ICT in education and what effect do these factors have on the implementation of ICT in the faculties?*
To answer the overall research questions the five organisational change questions as presented in Chapter 4, Section 4.1 will be used.

6.1.7 Unit of analysis

The unit of analysis is a critical factor in a case study. It is typically a system of action rather than an individual or group of individuals (Yin, 1994). Case studies tend to be selective, focusing on one or two issues that are fundamental to understanding the system being examined. In this research the unit of analysis can be described as the unit where the decision to use ICT in education is made. This can be at the level of the university itself, but also on faculty- and department level, but also even on a personal (instructor) level. To study and analyse the system of action in this research (the decision to use a new form of ICT in education and the implementation of this decision) the results of the case studies have to be brought to a higher level than the individual him or herself.

6.1.8 Collecting data

Stake (1995), and Yin (1994) identified at least six sources of evidence in case studies:

- Documents
- Archival records
- Interviews
- Direct observation
- Participant-observation
- Physical artefacts

Documents could be letters, memoranda or any other document that is relevant to the research. The documents can assist in confirming the evidence from other sources. Archival documents can be organisational records, lists of names, etc.

Interviews are one of the most important sources of case study information (Tellis, 1997). There are several forms of interviews that are possible: Open-ended, focused, and structured or survey. In an open-ended interview, key respondents are asked to comment about certain events. The researcher must avoid becoming dependent on a single informant, and seek the same data from other sources to verify its authenticity. The focused interview is used in a situation where the respondent is interviewed for a short period of time, usually answering set questions. This technique is often used to confirm data collected from another source. The structured interview is similar to a survey in which the questions are detailed and developed in advance.

Direct observation occurs when a field visit is conducted during the case study and participant-observation makes the researcher into an active participant in the events being studied. In addition to this physical artefacts (tools, instruments) can be collected during the study as part of a field visit.

As Yin points out, it is important to keep in mind that not all sources are relevant for all case studies (Yin, 1994). In this research documents (policy documents, reports on ICT in education, etc.) and archival records (number of staff and students, number of computer facilities, etc.) will be used. Direct observation, participant-observation and collecting physical artefacts will not be a direct goal of the case studies, but it can be imagined that this will be a natural process during the case studies (for example if the respondents demonstrate a particular new form of ICT in education).

6.1.9 Method of analysis (qualitative)

Analysing the data that is collected during a case study can be divided into two approaches, a qualitative and a quantitative approach. This section describes the qualitative approach, Section 6.1.10 discusses the quantitative approach.

Within the qualitative approach Yin (1994) describes the strategic approach. The role of such a strategy is to help the researcher to choose among different techniques and to complete the analytic phase of the research successfully. This was partly described in Section 6.1.3 on case study approaches and the seven Cs. According to Yin (1994) pattern-matching is one of the most desirable strategies within this approach. Pattern-matching compares an empirically based pattern with a predicted one (or with several alternative predictions). If the patterns coincide, the results can help a case study strengthen its internal validity. However if the case study is descriptive (as in this research) pattern-matching is only relevant as long as the predicted pattern of specific variables is defined prior to data

collection (Yin, 1994). Therefore, looking at the results of the literature study as described in Chapter 5, for this specific research about using new forms of ICT in education, pattern-matching seems to be the most suitable: in this research it is possible to make an attempt to use this technique, by comparing the four profiles as found in the literature study (Chapter 5) with the results from the case studies.
The second approach of analysing the data is more practical in nature and can consist of three concurrent flows of activity: data reduction, data display, and conclusion drawing / verification (Miles and Huberman, 1984). Miles and Huberman (1984) describe these flows of data as follows:

- Data reduction is the process of selecting, focusing, simplifying, abstracting, and transforming the raw data that appear in written-up field notes. Data reduction is needed, because the results of a case study will often contain a huge amount of data, gained from interviews, documents, etc. By making summaries of the results and/or by coding different variables or answers the researcher often reduces the information that is available without full awareness of this process. In addition to these processes intentional data reduction occurs to limit the amount of data. Examples of these are transforming the data into numbers, possibly using a statistical package.
- Data display is the way the results of a case study are presented. More information about this process is described in Section 6.1.11 about presenting the results. In this section about the method of analysis the focus will be on drawing conclusions or verifying the data by using several techniques for analysis of case studies, which are to some extent in compliance with the analysing procedures as described by Yin (1994).
- When analysing the results of a case study a distinction can be made between single cases and multiple cases. Analysing results of a single case study and drawing conclusions about this study is described as within-site analysis. When more case studies are carried out and the results of these studies have to be compared, cross-site analysis is used. During the analysis several analysis techniques are possible. Looking at the results of the literature study as described in Chapter 5 and considering what is written in this section about case study methodology, for a within-site analysis the effects matrix, the site dynamics matrix and probably the causal network seem to be the analysing techniques that could be applied in this research to distinguish the factors that have an influence on the decision to use a new form of ICT in education, to displays a set of forces for change (the ICT factors) and trace the consequential processes and outcomes (the five OC questions and the profiles). In a cross-site analysis scatter plots, site-ordered effects matrix and causal models and networks could be most applicable to reach the same objective as in the within-site analysis, but in a more comparative way.

6.1.10 Method of analysis (quantitative)

Many of the results that are gathered by using one or more analysis techniques can be described in a narrative way, using the different matrices. In some cases it is good to use a statistical package such as SPSS to gain more insight in the data by expressing them in quantitative form and then carrying out various analysis techniques. In addition to the more general ways of analysing data such as means, frequency tables and other statistics, factor analysis, ANOVA analysis and discriminant analysis can be used. These methods of analysis are briefly described here:

- *Factor analysis*
  Factor analysis attempts to identify underlying variables, or factors, that explain the pattern of correlations within a set of observed variables. Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of manifest variables (SPSS, 1998). Factor analysis can be used to identify which variables in the set cluster together, the variables that cluster together form a new factor (or component). With this method the amount of data will be reduced from the separate variables to a smaller number of clustered variables. In this research Principal Components Analysis (PCA) is used as a form of factor analysis. PCA is a statistical technique used to identify a relatively small number of factors that can be used to represent relationships among sets of interrelated variables. The original data is revised in a new system that requires only a few variables to account for most of the variation in the data. This new system is determined one component at a time, such that each successive component explains as much of the remaining variation in the data as possible. PCA was chosen as the extraction method of the factor analysis, because PCA can be used to obtain the initial factor solution. Varimax rotation is used to minimises the number of variables which have high loadings on each given component.

- The PCA component loading scores are stored in SPSS files. These are used to create new component scores. The component scores are calculated as linear combinations of the initial variable scores with the loadings of each variable in the extracted component. With the component scores new statistical analysis can be carried out. The component scores that were saved during the principal component analysis can be used to find information about the combination of the components as described in the previous section and the universities where the case studies were carried out. By performing an ANOVA analysis it is possible to determine which components have a significant influence on the universities.

- *ANOVA analysis*
  Analysis of variance (ANOVA) is a method of testing the null hypothesis that several group means are equal in the population, by comparing the sample variance estimated from the group means to that estimated within the groups. The ANOVA procedure produces a one-way analysis of variance for a quantitative dependent variable by a single factor (independent) variable. Analysis of variance is used to test the hypothesis that several means are equal. This technique is an extension of the two-sample t test. In addition to determining that differences exist among the means, it is possible to calculate which means differ. There are two types of tests for comparing means: a priori contrasts and post hoc tests. Contrasts are tests set up before running the experiment, and post hoc tests are run after the experiment has been conducted.

- *Discriminant analysis*
  Another way to see which group of respondents fits into which component a discriminant analysis can be carried out. Discriminant analysis is a statistical technique in which linear combinations of variables are used to distinguish between two or more categories of cases. The variables ‘discriminate’ between groups of cases and predict into which category or group a case falls, based upon the values of these variables (SPSS, 1986). The main use of discriminant analysis is to predict group membership

from a set of predictors. In other words, discriminant analysis is useful for situations where the goal is to build a predictive model of group membership based on observed characteristics of each case. The procedure generates a discriminant function (or, for more than two groups, a set of discriminant functions) based on linear combinations of the predictor variables that provide the best discrimination between the groups. The functions are generated from a sample of cases for which group membership is known; the functions can then be applied to new cases with measurements for the predictor variables but unknown group membership.

After analysing the data in a both qualitative and quantitative way the results have to be described and presented. This is described in the next section.

6.1.11 Presenting the results

Case study research is often classified as qualitative analysis (Miles & Huberman, 1984) but offers the possibility to combine qualitative with quantitative analysis (Winter, 2000). Nevertheless the main way of presenting the data that has been collected during the case study will be descriptive in nature. Or, according to Miles and Huberman (1984) the data concerned appear in words rather than in numbers. They may have been collected in a variety of ways (interviews, documents, etc) and are usually processed in some way (typing, editing, etc.), but they remain words, usually organised into extended text. Naturally numbers can be used to illustrate the words that describe the results. Miles and Huberman (1984) talk about 'data display' to describe the organisation of assembled information that permits conclusion drawing. The results of a research project can be presented in a variety of displays. Examples of these are matrices, graphs and charts. Such displays supply an extra means to extend the narrative text. In this way the information that is presented is more and better accessible, gives a better overview and it helps to draw conclusions.

Considering the preliminary choices for analysing techniques there are various ways of presenting the data. Usually data are presented in tables (matrices, charts, checklists) or figures. Using a specific form of presentation depends on what the researcher wants to accomplish with the display and how it best answers the research questions (Miles and Huberman, 1984). To present the results of this research both tables, matrices and figures will be used where appropriate.

6.1.12 Summary of methodological decisions

Yin (1994) recommended the use of case-study protocol as part of a carefully designed research project that would include the following sections:

- Overview of the project (project objectives and case study issues)
- Field procedures (credentials and access to sites)
- Questions (specific questions that the investigator must keep in mind during data collection)
- Guide for the report (outline, format for the narrative) (Yin, 1994, p. 64)

The first and third item of this protocol have been applied in Chapters 1 to 4. The field procedures and part of the guide for the report (presenting the results) are described in this chapter. In the previous sections methodological issues were described. The topics discussed form the basis of the case studies that have been designed. Table 14 summarises

the decisions that have been made in this chapter and also those that need further exploration during the test case study.

Table 14 Summary of methodological decisions and decisions to be explored

	Decision	Further exploration needed
Single or multiple cases	Multiple cases	
Case study approaches	Descriptive approach (Yin, 1993) Interpretative approach (Willis, 1998) Mixed methods: qualitative, quantitative and comparative (Chenail, 2000)	
Case study components		Which combination of: Five components of research design (Yin, 1994) Six steps in conducting case study research (Soy, 1998)
Collecting data	Documents Archival records Interviews	Direct observation Participant-observation Physical artefacts
Method of analysis (general)	Data reduction (Miles and Huberman, 1984)	Pattern-matching (Yin, 1994)
Method of analysis (within-site)	Effects matrix Site dynamics matrix	Causal network
Method of analysis (cross-site)	Scatter plots Site-ordered effects matrix	Causal models Causal networks
Method of analysis (statistical)	Means Frequency tables	Cross-tab analysis Principal component analysis Discriminant analysis
Presenting the results	Data display	Matrices Tables Figures
Guide for the report		Outline

The table is divided into two columns. The first column presents the decisions that have been made based upon the findings of the previous chapters. In the column “further exploration needed” the choice for a methodological procedure has not been made yet, because at this moment there was not enough indication to do so. To explore these issues related to case study components, method of analysis and presenting the results in a report a test case study was designed and carried out. The intention of designing such a test case study is to make a better choice for one or more of the topics to be explored. This is described in the next section.

6.2 Design of the test case study at the George Washington University

This section gives an overview of the design of the test case study at the George Washington University. Following the brief overview and the goals of this case study, more elaborated information is given about the case study approach, the research questions and the selection of cases and respondents. Next an overview is given of the process of data collection and the method of analysis.

6.2.1 Overview of the case study

Based on the theoretical framework presented in Chapters 2 and 3, the literature study in Chapter 5 and the decision to use a case study method to find answers to the overall research question (described in Section 6.1) a test case study was designed. This test case study was carried out at the George Washington University, Washington DC, USA. The design of the case study is based on the objective to find an answer to the overall research question and the sub Research Questions 3 to 8. In addition to this the methodology as decided upon in Section 6.1, Table 14, is evaluated to explore possible additional methodological issues and to make recommendations about designing the other case studies in this research.

It is important to note is that the test case study is a single case. Therefore no decisions can be made about cross-site analysis. However, from the test case it may be possible to make some recommendations about these issues related to cross-site comparisons. In Table 15 an overview is given of the variables used in the case study.

Table 15 Overview of the variables used in the test case study at GWU

Variable	Values
Task of the respondents	Rector Policy advisor Head of department Support unit (educational) Support unit (technical) Support person faculty Instructor/researcher Student
Role of the respondents	Policy Support Education
Form of ICT	Only the electronic learning environment Prometheus Only Websites Only computer based training Only videoconferencing Combination of applications without Prometheus Combination of applications including Prometheus
Implementation scale	Incidental, one or more instructors Increasing awareness, at all levels Coordinated and supported activities Integrated in teaching and learning

Table 15 continues...

Table 15 (continued)

The five OC Questions (see Chapter 2, section 2.4.3):	
Cause	Social fitness *versus* economic fitness
Constituents	Multiplicity of constituent demands *versus* dependence on institutional constituents
Content	Consistency with organisational goals *versus* discretionary constraints imposed on the organisation
Control	Coercion or enforcement *versus* voluntary diffusion of norms
Context	Environmental uncertainty *versus* environmental interconnectedness
The 38 ICT factors (see Chapter 3, Section 3.3.7)	Indicated as important: yes or no
Profiles (See Chapter 5, Section 5.4)	Supporting learners in a changing world Developing expertise in the university Surviving in a competitive world Evolving to a cost-effective approach

These variables were used in the test case study. The case study approach, the design components and the research questions were described in Section 6.1. The following sections describe the decisions that were made for this specific test case study in relation to the unit of analysis (Section 6.2.2), the process of data collection (Section 6.2.3), the instrumentation for data collection (Section 6.2.4), method of quantitative and qualitative data analysis (Section 6.2.5 and 6.2.6) and presenting the results (Section 6.2.7). Section 6.2 concludes with an overview of the results report in Section 6.2.8.

6.2.2 Unit of analysis

The George Washington University was treated as a separate test case within the research. The results of this case study will not be included in the end result of the overall case study, because of the nature of this test case. The focus within this case study was upon (a) the specific features that are important to answer the research question in relation to organisational change and ICT in education and (b) on the evaluation of the methodology as proposed in Section 6.1.

Within this test case several respondents are selected to take part in the research. The respondents per institution were selected based on the advice of a leading person in the field of ICT in education at the George Washington University. This expert introduced the respondents as experts and interested faculty members, divided over a number of faculties and support units. Details of the respondents are given in the description of the results.

6.2.3 Data collection

The data to answer the research questions were gathered by doing interviews with the persons as described in the previous section about the unit of analysis. The interview consisted of two parts: (a) an interview with open-ended questions (see Appendix D) and (b) reactions of the respondents to an instrument called the ICT Factors score table (see Appendix E).

The interview consisted of five main components.

1. The first part was dedicated to the function of the respondent and his or her relation and experiences to the use of new forms of ICT in education. General information about the experiences of the respondent and the experiences of the academic unit (department, faculty, university) was the outcome of this part of the interview.
2. The second part of the interview was focused more specifically at the research questions of this study. The questions related to the factors that could be important in the decision to use ICT in education were posed.
3. During the third part of the interview the interviewer explained the ICT Factors score table and asked the respondent to mark the factors that have been important in his or her situation in relation to the use of new forms of ICT in education.
4. In the fourth part of the interview the interviewer showed the respondent the results of the literature study in relation to the five OC questions and asked the respondent to react on these.
5. During the final part of the interview the interviewer showed the profiles that were the result of the literature study and asked the respondent to put his or her context into one of the profiles.

To assure validity and reliability a diversity of respondents were chosen in order to avoid becoming dependent on a single group of informants with a specific role. Furthermore, in addition to the interviews, documents and archival records (policy and strategy documents) and observation (of demonstrations of specific ICT applications) were used for collecting data. The drafts of the case study reports of the individual universities were sent to key informants (the experts who introduced the respondents) for comments and verification.

6.2.4 Instrumentation for data collection

To structure the interview the interviewer used the form as included in Appendix D. The ICT Factors score table that was used for the third part of the interview is included in Appendix E. The instruments are based on the research questions as presented in Section 6.1.6. The ICT factors score table with the 38 ICT factors was derived from Table 10 in Chapter 5.

6.2.5 Method of analysis (qualitative)

In Section 6.1 the following decisions were made about the method of analysis. Data reduction was applied to select, focus, simplify, and transform the raw data that emerged from the interviews and the documents used. In the test case study this was done by summarising the answers of the respondents, using matrices to describe the results and coding the variables for use in SPSS. Because the test case study is a single case study, only within-site analysis took place, including a site dynamics matrix.

6.2.6 Method of analysis (quantitative)

Except for standard statistical methods such as means and frequencies no advanced statistical methods were used in this single case study. The advanced statistical techniques were used in the cross-site analysis of the four European case studies (see Chapter 8).

6.2.7 Presenting the results

In addition to what was described in Section 6.1.11 it was decided that in this test case study the results were presented in different ways. In addition to text-based presentations matrices

were used to present the results. In this test case study a variety of ways to usefully present results were examined and tested.

6.2.8 Guide for the report

The report of the test case study is structured as follows:

- General description of the university
- Overview of ICT-related aspects at the university
- Results: Respondents and ICT at GWU
- Results: Factors that influence the use of new forms of ICT
- Results: Organisational change
- Results: Profiles
- Summary and Conclusion
- Recommendations for adaptation of the EUNITE case studies design

6.3 Results of the test case study at the George Washington University

With the design of the test case study as described in the previous section the test study was carried out. In this section the results of the case study are described. A description is given of the university in general and specific issues related to ICT in education are discussed. Next, some general information about the respondents and about the way the respondents use ICT in education with regard to form and scale is described. Following this, the most important factors that have an influence on the use of new forms of ICT in education are summarised and the answers to the five OC questions as given by the respondents are outlined. After the conclusion and a discussion of the results recommendations for the adaptation of the design of the subsequent case studies is given.

6.3.1 General description of the university

This section gives a general description of the George Washington University and is primarily based on the information available on the university's Website (http://www.gwu.edu).

The George Washington University is an independent academic institution chartered by the Congress of the United States in 1821. According to its mission statement, the university dedicates itself to furthering human well-being and values a dynamic, student-focused community stimulated by cultural and intellectual diversity and built upon a foundation of integrity, creativity, and openness to the exploration of new ideas. Furthermore, the mission statement of the university states that

> "to promote the process of lifelong learning from both global and integrative perspectives, the university provides a stimulating intellectual environment for its diverse students and faculty. By fostering excellence in teaching, the University offers outstanding learning experiences for full-time and part-time students in undergraduate, graduate, and professional programs in Washington, D.C., the nation, and abroad. As a center for intellectual inquiry and research, the University emphasizes the linkage between basic and applied scholarship, insisting that the practical be grounded in knowledge and theory. The University acts as a catalyst for creativity in the arts, the sciences, and the professions by encouraging interaction among its students, faculty, staff, alumni, and the communities it serves. The George Washington University draws

upon the rich array of resources from the National Capital Area to enhance its educational endeavors. In return, the University, through its students, faculty, and staff, and alumni, contributes talent and knowledge to improve the quality of life in metropolitan Washington, D.C.".

The George Washington University is accredited by its regional accrediting agency, the Middle States Association of Colleges and Schools. The university is on the approved list of the American Association of University Women and is a member of the College Board. There are approximately 6000 staff members (4500 academic staff), 8000 undergraduate students and 7750 graduate students.

The university has eight different schools: Columbian School of Arts and Sciences, School of Business and Public Management, Graduate School of Education and Human Development, School of Engineering and Applied Science, Elliott School of International Affairs, The George Washington University Law School, School of Medicine and Health Sciences and the School of Public Health and Health Services. Combining these schools, there are almost 100 departments.

6.3.2 ICT at the university

This section describes the ICT-related activities of the George Washington University and is primarily based on the information of the Libraries, Computing, & Information Resources Website (http://www.gwu.edu/lcir.html), the information about the electronic learning environment Prometheus (http://www.prometheus.com/) and a report on distance education at the George Washington University (Saunders, & Christensen, 1998).

Report on distance education and ICT initiatives

In 1998 the Distance Education Working Group presented a report on distance education at the George Washington University (Saunders, & Christensen, 1998). This report identified current initiatives and experience with distance education throughout the University and offered recommendations as to whether GWU should become involved in offering distance education programs and courses beyond the current initiatives. This report was one of the first attempts to describe the ICT-related activities at the university.

The conclusions from the working group were that the George Washington University was well positioned to take advantage of the rapid developments in technology to develop further its reputation in the field of distance education and to increase its competitiveness in many of its graduate and professional programs. To that end it was suggested that support services and training be developed and provided for faculty, professional staff and students in distance education programs.

In relation to this it was suggested that a strategic plan for distance education was urgently needed to facilitate and support existing and new programs and to establish guidelines and procedures and that a separate office dedicated to providing the above mentioned services should be developed. This office could advise schools and divisions interested in developing distance education programs; and externally, work collaboratively with potential corporate and academic partners in developing and delivering distance education programs when it is in the University's best interest to do so.

This in turn meant that the university should provide seed funding and support to establish a strong reputation for conducting research into the many sub-topics related to distance education and to enabling technologies. The GWU administration at the highest levels must ensure commitment of adequate resources to distance education efforts including, but not limited to, support staff, teaching assistants, faculty, professional staff, technology upgrades, operational space and requisite financial support to build and maintain a quality effort.

The working group recommended that in order to maximise activities in distance education at the university a task force was appointed to develop a strategic plan in distance education that would encompass all components of the University and would establish guidelines and procedures for new programs. Also, significant resources to provide for the development of an infrastructure and to provide seed dollars to develop new initiatives in this area should be provided.

After presenting this report several initiatives started. A number of so-called computing resources, such as the Instructional Technology Lab and the Center for Distance and Mediated Learning were established and Prometheus, a Web-based teaching and learning environment was developed.

Prometheus
Prometheus is a Web-based courseware application that allows instructors to post course related information for students and conduct courses online in a secure environment. In the first 90 days after the 1998 launch of Prometheus at the George Washington University, 100 faculty members had logged on and created courses. In the spring of 1999, there were over 600 courses online and 5,000 students using the system. At the beginning of 2001 17,000 students are using Prometheus. This is 85 percent of the George Washington University's student population. Over 1,000 faculty members are teaching 1,800 courses online with little or no formalised training. In June 2001 about 20 percent of all academic staff members of GWU use Prometheus as a means to support education.

The George Washington University developed Prometheus in answer to the need for an easy-to-use, scalable enterprise-wide learning platform designed to allow customisation for faculty, administrators, and students. Prometheus was designed from the beginning as an enterprise solution meant to scale for an entire campus population. Built on a ColdFusion application layer, Prometheus is designed to grow quickly and easily while integrating cleanly with database, browser, and server functions. ColdFusion's modularity makes it easy for partners to build applications in various languages and then plug them directly into the Prometheus architecture.

The Instructional Technology Lab
The Instructional Technology Lab provides support to faculty using Prometheus by providing workshops on basic and advanced use of the system. The ITL also assist faculty in their application of sound instructional design in the creation of curricular materials. Also, the ITL provides the facilities and support necessary to use advanced multimedia software and hardware to create innovative and effective instructional materials. In addition to this the ITL, through intensive workshops and labs will work collaboratively with faculty and graduate student teams to provide support for prototype multimedia projects.

The Center for Distance and Mediated Learning
The mission of the Center for Distance and Mediated Learning (CDML) is "to create a 21st century university model which embraces lifelong learning as a guiding principle and combines high standards with extraordinary convenience in the service of educational value". CDML was established to serve as a focal point for information distribution, instructional design, and personnel development related to distance and mediated learning. Consequently, the Center is committed to providing leadership and support for all members of the university community and its clients by providing access to relevant and timely information, referrals to resource centres, and models for related systems development. CDML also works actively for the establishment and maintenance of university administrative and technological structures appropriate to the highest quality institutional outcomes.
Based on this information the interviews during the case study at the George Washington University were carried out. The results are presented in Sections 6.3.3 - 6.3.6.

6.3.3 Results: Respondents and ICT at GWU

During the case study at the George Washington University nine respondents were interviewed. One of the respondents was Associate Vice Chancellor, three of the respondents were head of a department, three other respondents were support persons (educational and technological and two respondents were instructors. Because of the limited number of respondents the tasks of the respondents have been combined into new categories in order to make further calculations more useful. The Associate Vice Chancellor and the heads of the departments have been combined in the role of "policy". Respondents from the educational and the technological support units and the support persons in a faculty or department have been combined in the role of "support". The instructors are placed in the role "education". This is shown in Table 16. These roles are used for further calculations.

Table 16 Roles of the respondents at GWU

	Frequency	Percent of sample
Policy	4	44.4
Support	3	33.3
Education	2	22.2
Total	9	100.0

The respondents were asked to answer the interview questions to their best knowledge. If the questions related to situations in which some of the respondent had no personal experience the respondents were asked to give their perception of an overall view of the university. For instance it is possible that a question about using a particular ICT application in education cannot be answered for a specific teaching context by the respondents that fit in the category "policy". Therefore they have given their view on the questions in relation to the whole university context.

Each of the respondents indicated which new form of ICT is used at the George Washington University. This is presented in Table 17.

Table 17 Form of ICT at GWU

	Frequency	Percent of sample
Only the electronic learning environment Prometheus	0	0
Only Websites	2	22.2
Only computer based training	0	0
Only videoconferencing	0	0
Combination of applications without Prometheus	0	0
Combination of applications including Prometheus	7	77.8
Total	9	100.0

As can be seen from Table 17, seven out of nine of the respondents indicated that staff members at the university use of a combination of applications (usually Websites, e-mail and domain specific computer programmes) and Prometheus, the electronic learning environment.

In Table 18 an overview is given of the perceived implementation scale of ICT in education according to the respondents of the George Washington University.

Table 18 Implementation scale at GWU

	Frequency	Percentage of sample
Incidental, one or more instructors	2	22.2
Increasing awareness, at all levels	2	22.2
Coordinated and supported activities	5	55.6
Integrated in teaching and learning	0	0
Total	9	100.0

As can be seen the perceived scale of implementation ranges from incidental implementation from some instructors to coordinated and supported activities to implement ICT in education. The respondents did not indicate that there is implementation of ICT at such a scale that it is integrated in teaching and learning throughout the university.

From Table 17 and Table 18 it can be expected that there is some correlation between the new form of ICT that is chosen and the scale of implementation. Statistical calculation of the correlation between these two components is not useful for a limited number of respondents, but in Table 19 a simple effect matrix is presented in which the relation between the form and the scale is shown.

Table 19 Effect matrix implementation scale after choice for form ICT

Respondent	Use of new form of ICT as perceived by respondents	Implementation scale as perceived by respondents
1	Websites	Incidental, one or more instructors
2	Websites	Incidental, one or more instructors
3	Combination of applications including Prometheus	Increasing awareness, at all levels
4	Combination of applications including Prometheus	Increasing awareness, at all levels
5	Combination of applications including Prometheus	Coordinated and supported activities
6	Combination of applications including Prometheus	Coordinated and supported activities
7	Combination of applications including Prometheus	Coordinated and supported activities
8	Combination of applications including Prometheus	Coordinated and supported activities
9	Combination of applications including Prometheus	Coordinated and supported activities

The results from Table 19 suggest that there is a relationship between the new form of ICT that is chosen and the perceived scale of implementation:

- The two respondents that perceived that only Websites in education are used indicated that there is incidental implementation by some instructors.
- Two of the respondents that perceived that a combination of applications including an electronic learning environment were used indicated that there is increasing awareness at all levels of the university or department.
- Five of the respondents that perceived that a combination of applications including an electronic learning environment were used indicated that there are coordinated and supported activities.

From these results it is suggested that if the decision is taken to support an electronic learning environment there is at least an increasing awareness at all levels in the organisation in relation to the potential use of ICT in education, but coordinated and supported activities to implement ICT in education are perceived as being available.

This section presented the general information about the respondents, the way new forms of ICT is used and the perceived scale on which ICT is implemented. In the next section more information is given about the factors that influence the use of new forms of ICT at the George Washington University.

6.3.4 Results: Factors that influence the use of new forms of ICT

The factors that could have an influence on the use of new forms of ICT in education as indicated by the respondents in the ICT Factor score table responses are summarised in Table 20:

Table 20 Totals of ICT factors at GWU

(n=9)

Factors	Number of respondents	Factors	Number of respondents
Educational and technical support	8	Benefits	4
Focus on learner/learning	8	Cost-effectiveness	4
Flexibility	8	New teaching models	4
Emerging technology	7	Dependence on IT	4
Demands from learners	7	Demands from employers	4
Competition	7	Changing stud. demographics	4
Lifelong learning	7	Dynamic environment	4
Availability technology	6	Leadership	3
Administrative support	6	New conceptions of learning	2
Part-time students	6	On-demand training	2
New market	6	Individual differences	2
Active learning	5	Broad participation	2
Improved access to education	5	Education as business	2
(new) organisational structure	5	Concrete plans	1
New technology (push, hype)	5	Shared vision	1
Response to threats and opportunities	5	Reducing costs	1
Partnerships	5	Knowledge management	1
Funding	5	Tailor-made products	0
Availability facilities	4		

From this table it can be seen that the factors that have been mentioned most by the respondents are related to support facilities, educational developments, technology developments, environmental pressures and institutional conditions. Cost-reduction seems to be less important; four respondents on the other hand mention cost-effectiveness.

6.3.5 Results: Organisational change

In the Figure 5 the answers of the respondents to the five OC questions (as presented in Chapter 4, Section 4.1) are represented and described after the figure.

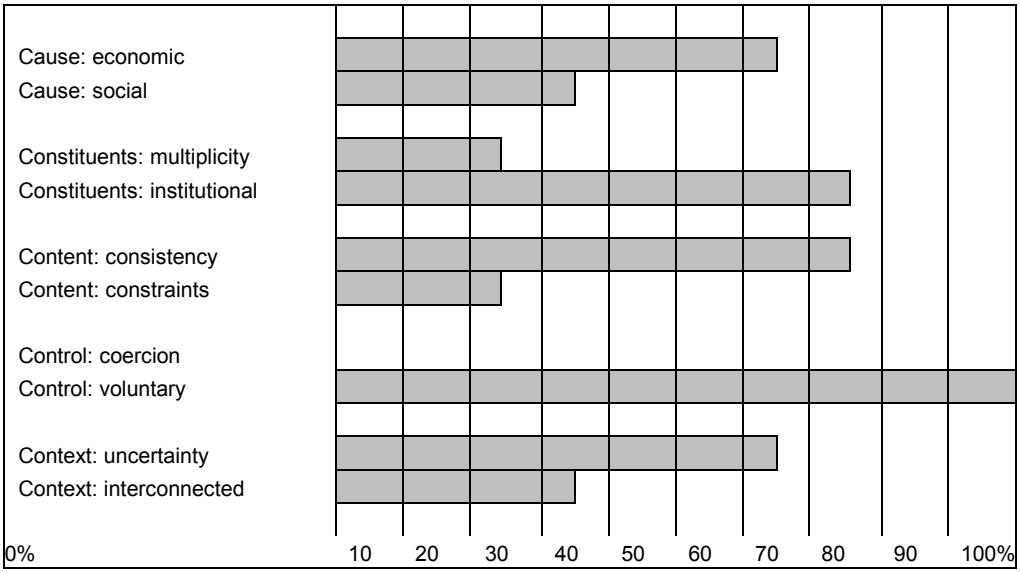

Figure 5 Results on the five organisational change questions related to organisational change, choice of dimension alternatives (GWU)

The cause of the change
The first question of the five questions related to Oliver's dimensions was "Does the university perceives itself as being pressured to use ICT in education? and if so, why?". According to Oliver (1991) two general answers are possible: organisations change because of legitimacy or because of efficiency. Legitimacy can be explained as social fitness and efficiency as economic fitness.

The respondents of the George Washington University indicated that they have been influenced to use ICT in education by the factors as described in the previous section. Three out of nine respondents indicated that new forms of ICT are used in education because of social reasons. These reasons relate to improving the quality of education, based on the idea of supporting the students with additional information and feedback. Six respondents say that there are economic reasons to use ICT in education. Attracting more students outside the D.C. area and from business and industry are the main indications for this.

The constituents of the change
The second of the five questions was "Who is exerting institutional pressure on the organisation?" (the constituents of the change). According to Oliver (1991) two general answers are possible in relation to the constituents of the change: multiplicity of constituent demands or dependence on institutional constituents.
The majority of the respondents (seven out of nine) say that using new forms of ICT in education depends most of all on institutional constituents. The two respondents who say that there is a multiplicity of constituent demands are respondents who have to deal with attracting students from outside the regular student population market: one of the vice-chancellors of the university and a head of a department that offers education to students from business and industry.

The content of the change
The third OC question in this research is "To what norms or requirements is the organisation being pressured to conform?" (the content of the change). Values for the dimensions are the consistency with organisational goals and discretionary constrains imposed on the organisation. These answer dimensions were interpreted as whether using new forms of ICT has brought a change in the way education is delivered or not. From the table it can be seen that most of the respondents indicate that there has been no real change in the way education is offered. Only two respondents say that there has been a change with regard to offering education. These respondents suggested that this has been part of a longer process in which the instructor had learned how to use the technological part of using new forms of ICT in education first and began to use it more effectively (pedagogically) after this learning process. The change in education relates to including more resources (simulations, hyperlinks to other Websites) and to providing feedback on a Website or through the use of e-mail.

The control of the change
The fourth question is "How or by what means are the institutional pressures being exerted?" (the control of the change). For the control of the change the values of the dimension are legal coercion or enforcement, and voluntary diffusion of norms.

None of the respondents indicate that they have perceived some kind of coercion to use ICT in education. Some of the respondents reported some peer pressure: if an other instructor uses ICT in education they felt almost compelled to use it too, to keep on track with the colleagues. But the respondents did not feel that this peer pressure could be categorised under coercion or enforcement.

The context of the change
The last OC question is "What is the environmental context within which institutional pressures are being exerted?" (the context of the change). The values for this dimension are environmental uncertainty and environmental interconnectedness. Six of the respondents indicated that there is a certain amount of uncertainty in relation to the context of the university or department. This uncertainty relates to particularly to the decreasing budget that is available for education. Most of these respondents indicate that ICT will have just a minor role in solving this uncertainty. If ICT will play a role it will be in the case of co-operation with business and industry: offering education to employees, supported by technology or offering education to regular students with input (such as guest lectures) from companies.

From these results related to organisational change the step toward identifying profiles is made in the next section.

6.3.6 Results: Profiles

In Chapter 5 (describing the literature study) four profiles were outlined. If the four profiles are constructed for the George Washington University by making a cross-tab analysis of the dimensions cause and context of the change the following results can be presented in Table 21.

Table 21 Profiles for GWU

	Frequency	Percent of sample
Supporting learners in a changing world	2	22.2
Developing expertise in the university	1	11.1
Surviving in a competitive world	4	44.4
Evolving to a cost-effective approach	2	22.2
Total	9	100.0

As can be seen all of the four profiles were indicated by the respondents of the George Washington University, but Profile 2 has only one respondent associated with it and Profiles 1 and 3 only 2 respondents. Profile 3, "Surviving in a competitive world" seems to be the profile that is most appropriate for this sample of respondents at the George Washington University. It is possible to analyse which of the ICT factors are specifically interesting for each profile. For that objective Table 22 has been constructed in which the factors per profile are presented if they are mentioned as important for at least 50 percent of the respondents within that profile. The results of Table 22 have to be treated with some consideration, because of the small number of respondents associated with the profiles. The results for Profile 3 are in this case the most interestingly.

Table 22 ICT Factors per profile (GWU)

(✔ if 50% or more of the respondents choosing the profile also chose the factor)

Factors	Profile 1 Supporting learners in a changing world (n=2)	Profile 2 developing expertise in the university (n=1)	Profile 3 Surviving in a competitive world (n=4)	Profile 4 Evolving to a cost-effective approach (n=2)
Partnerships	✔	✔	✔	✔
Flexibility	✔	✔	✔	✔
Emerging technology	✔	✔	✔	✔
Focus on learner/learning	✔	✔	✔	✔
Educational and technical support	✔	✔	✔	✔
Funding	✔	✔	✔	
Dynamic environment	✔	✔	✔	
New organisational structure	✔	✔	✔	
New teaching models	✔	✔	✔	
Active learning	✔	✔	✔	
New technology (push, hype)	✔	✔		✔
Part-time students	✔		✔	✔
Competition	✔		✔	✔
Changing student demographics	✔		✔	✔
Response to threats and opportunities	✔		✔	✔
Demands from learners	✔		✔	✔

Table 22 continues...

Table 22 (continued)

Dependence on IT	✓		✓	✓
Improved access to education	✓		✓	✓
Cost-effectiveness	✓		✓	✓
Administrative support	✓		✓	✓
Availability technology	✓		✓	✓
Lifelong learning		✓	✓	✓
Benefits		✓	✓	✓
Availability facilities	✓			✓
New market			✓	✓
Demands from employers			✓	✓
Leadership			✓	✓
On-demand training	✓			
Knowledge management		✓		
Broad participation		✓		
New conceptions of learning		✓		
Individual differences		✓		
Reducing costs		✓		
Education as business				✓

From the table it can be seen that there are five ICT factors that are common for all the profiles. These factors are partnerships, flexibility, emerging technology, focus on learner/learning and educational and technical support.

Looking at factors that are indicated as important in two or three profiles it can be seen that there are some clusters of factors. For example, the factors funding, dynamic environment, new organisational structure, new teaching models and active learning seem to be important in the Profiles 1, 2 and 3 and not in Profile 4 in which the motives for using new forms of ICT are economic and the context of the university is certain. A large clustering of factors can be seen for the Profiles 1, 3 and 4. The cluster of factors consist of part-time students, competition, changing student demographics, response to threats and opportunities, demands from learners, dependence on IT, improved access to education, cost-effectiveness, administrative support and the availability technology. From this it can be seen that a university that fits in Profile 2 (with social motives to use new forms of ICT in a certain environment) has less environmental pressures to use new forms of ICT in education and is more influenced by other factors.

To examine these other factors Table 22 shows in the lower grey cells those factors that can only be placed in one profile. On-demand training is the only factor that is mentioned only once in Profile 1. Knowledge management, broad participation, new conceptions of learning, individual differences and reducing costs are factors that are only mentioned once in Profile 2. There are no factors that are only related to Profile 3, but the factors new market, demands from employers and leadership are factors that are mentioned in the Profiles 3 and 4 only. Profile 4 distinguishes itself from the others by the factor education as business.

6.3.7 Relation of the four profiles and the implementation of new forms of ICT

It is possible to examine the relation between the four profiles with which the respondents of the university are associated, the form of ICT that has been chosen and the level of implementation. The results of this analysis is presented in Table 23.

Table 23 Combining the four profiles and the implementation of new forms of ICT (GWU)

New form of ICT	Level of implementation	Profile 1	Profile 2	Profile 3	Profile 4
Only Websites	Incidental, one or more teachers	50%	50%	0%	0%
Combination of applications including Prometheus	Increasing awareness, at all levels	0%	0%	100%	0%
	Coordinated and supported activities	20%	0%	40%	40%

As can be seen in Table 23 Websites (implemented by one or more teachers) are associated with Profiles 1 and 2 at GWU. The combination of applications, including the electronic learning environment Prometheus has two levels of implementation. The level of increasing awareness at all levels is for 100% associated with Profile 3. The level of coordinated and supported activities is associated with Profile 1, 3 and 4. From this it can be seen that that within the Profiles 1 and 2 (both related to a social motive to use new forms of ICT in education) incidental implementation can be found. The higher levels of implementation are primarily associated with Profiles 3 and 4 in which the economic motives to use new forms of ICT are important. From this it could be concluded that in order to reach higher levels of implementation of new forms of ICT in education, economic motives play a major role in facilitating and supporting the implementation.

6.3.8 Summary and Conclusion

It seems that the George Washington University, with the development of the electronic learning environment Prometheus and the availability of support units and persons, is evolving to a university that makes an effort to integrate ICT in education. This observation is based on the results in relation to the form and scale of the use of new forms of ICT that suggest that (a) there is a trend towards the use of a combination of applications (Websites, e-mail and domain specific computer programmes) and Prometheus and (b) that there are coordinated and supported activities to implement ICT in education.

Looking at the ICT factors that are mentioned by at least 6 (66%) of the respondents it can be seen that next to educational and technical support, environmental pressures such as the need for flexibility, demands from learners, competition part-time students and lifelong learning are important factors for the GWU to use ICT in education. The increasing role of the Instructional Technology Lab with regard to its support for implementing ICT and the Prometheus system in education is seen as important by the respondents.

Factors that are of minor importance are related to reducing the costs of education and institutional conditions such as broad participation, concrete plans and shared vision. This may explain in part why the scale of implementation of ICT in education is not yet as large as may be expected. But the respondents indicated that there has been an effort to strive for concrete plans by writing reports about ICT in education. An example of this is the report

on distance education at the George Washington University (Saunders, & Christensen, 1998) as described in Section 6.3.2.

In relation to organisational change the results show that the majority of the respondents have a social reason to use and support ICT in education and the support for ICT in education has been initiated primarily from internal constituents. It seems that at the moment of the case study there has been no distinct shift in the way education is offered related to the way the instructor uses ICT in education, but it is expected that this is in a process of change. Time is needed for instructors to adapt to new ways of teaching with technologies. The use of new forms of ICT and its support has happened voluntarily. No pressure or enforcement has been experienced. The context of the university, primarily experienced as unstable or uncertain, will have some influence on the use of new forms of ICT, but it is expected that the uncertain environment will have just a minor role in implementing new forms of ICT in education.

With regard to the profiles that were described, the profile "Surviving in a competitive world" seems to be the most favored. This profile combines economic reasons for using new forms of ICT in education and the fact that the environment around the organisation (university, department, etc) is uncertain. The factors that distinguish Profile 3 in the literature study in Chapter 5 were lifelong learning, changing student demographics and demands from learners. At the GWU there is a difference in factors given priority by those respondents choosing different profiles: there are no real distinguishing factors for Profile 3, only factors that are mentioned in both Profile 3 and 4: new market, demands from employers and leadership. From this it can be seen that there is a difference between the results of the literature study and the test case study in terms of ICT factors associated with the profiles, although there is some agreement on factors that are not associated with the profiles. Only Profile 3 is discussed here, because there were only one or two respondents associated with the other profiles. Profile 3 changed from lifelong learning, changing student demographics and demands from learners in the literature study to factors that are mentioned in both Profile 3 and 4 in the GWU case study: new market, demands from employers and leadership. This suggests a shift from student-related environmental pressures to market-related pressures. Even though these results imply major changes it is possible that this is because of the small number of participants and because of the types of persons that have written the papers and articles as analysed in Chapter 5. How to deal with this in the other case studies is discussed in the next section with recommendations for adaptation of the EUNITE case studies design.

To conclude this section a site dynamics matrix is presented based on the interviews in which the relation of the ICT factors with the new form of ICT that was chosen and the implementation scale of this form is presented.

Table 24 Site dynamics matrix: possible relation of ICT factors, form of ICT and implementation scale at GWU

Categories of ICT factors that influence the decision to support some new form of ICT in education	Most important factors (mentioned by at least 50% of the respondents)	Relation with supported new form of ICT in education (as perceived by the researcher)	Implication for the scale of implementation (as perceived by the researcher)
Environmental pressures	Flexibility Demands from learners Competition Lifelong learning Part-time students New market Response to threats and opportunities Partnerships Funding	The environmental pressures caused the university to consider the possibilities that ICT offers to support education, especially related to Web-based applications such as Webpages, e-mail and the Prometheus system.	Increased importance for coordinated and supported activities throughout the university, ultimately leading to the complete integration of ICT in education.
Technology developments	Emerging technology New technology (push, hype)	The possibilities of technology in combination with the push to use new technologies resulted in more advanced use of Web-based applications and stimulated the development of the Prometheus system.	By experimenting with the possibilities of new technologies both large-scale implementation of ICT and smaller, specialised projects are possible.
Institutional conditions	Improved access to education (new) organisational structure	By offering improved access to education the university is accounting for the environmental pressures as perceived by the respondents. A new organisational structure in the form of developing ICT support units was needed to achieve this.	Only by combining the new organisational structure, making concrete plans and assuring broad participation it is possible to implement and support ICT on a large scale

Table 24 continues…

Table 24 (continued)

Educational developments	Focus on learner/learning Active learning	The focus on the learner and the learning process in combination of active learning are essential parts of the ICT-supported learning environment. The Websites and the Prometheus system can support this.	The educational developments in relation to ICT in education contribute to the increasing awareness of the instructors with regard to the possibilities of ICT in education. Proving the usefulness, effect and efficiency of ICT-supported education will have an effect on the implementation scale.
Cost reduction / Cost-effectiveness	-	At this moment other issues related to the other categories of factors are more important than cost issues.	In time cost-related issues will play a role on the implementation scale. When using a university-wide system such as Prometheus several cost issues will become visible, not only including financial issues, but also time and effort of instructors, students and support units.
Support facilities	Educational and technical support Availability technology Administrative support	Support facilities have been set up to co-ordinate and support the implementation of the new form of ICT that is chosen by the staff members of the university. These support facilities are essential for the increasing the awareness of the possibilities of the forms of ICT-use.	With sufficiently organised support units the implementation scale of ICT in education can evolve from raising awareness about the possibilities to coordinated and supported facilities to the integration of ICT in the teaching and learning process.

6.4 Recommendations for adaptation of the EUNITE case studies design

Reflecting on the case study at the George Washington University the following recommendations can be made for the design of the EUNITE case study design. These recommendations are categorised into general recommendations and recommendations about the methodology as followed during the GWU case studies.

6.4.1 General recommendations

At the start of the test case study it was known that more respondents were needed. Not only would this increase the reliability of the results and the representation of the number of the respondents in relation to the number of staff members at the university, it would also allow for more sophisticated statistical analyses. Nevertheless it was decided to carry this case study out with this limited number of participants, because of the nature of the study: a test in which possible additional methodological issues are explored and in which recommendations about designing the other case studies in this research are made.

In the section about data collection (6.2.2) it was suggested that during the final part of the interview the interviewer shows the profiles that were the result of the literature study and asks the respondent to put his or her context related to using new forms of ICT in education into one of the profiles. From the experiences of the test case study it appears that it is difficult for the respondents to relate the personal context to one of the profiles without more background information. It is recommended to establish the profile via the combination of the "cause" and the "context" organisational change questions themselves. In this way it is possible to determine the profile of the respondent without asking directly.

6.4.2 Recommendations with regard to the methodology

In Section 6.1.12 Table 14 was presented with a summary of the methodological decisions and issues to be resolved for the case studies. It is recommended to keep the proposed methodological approach for the EUNITE case study. the only adjustments are made to the case study components and the guide for the report (both issues that had to be examined in the test case study). It was suggested that when describing the case study components a combination of the approaches of Yin (1994) and Soy (1998) should be used. This should be revised for the EUNITE case studies to:

- Overview and goals of the case study
- Research questions
- Case study approach
- Selection of cases and respondents
- Data collection
- Instrumentation for data collection
- Method of analysis (qualitative)
- Method of analysis (quantitative)
- Guide for the report

In relation to the last item in this list it is recommended that the report of the results of the EUNITE case studies consists of the following topics:

- General description of the university
- ICT at the university
- Results: General information
- Results: Factors that influence the use of new forms of ICT
- Results: Organisational change
- Results: Profiles
- Synthesis

Two ways of collecting data have been removed from the methodological decisions as presented in Section 6.1.12 in Table 14. These are participant-observation and physical artefacts. These two do not apply to the settings of the case studies that are being carried out in this research. In addition to this it cannot be said if causal models and networks can be used as method of analysis in both the within-site and the cross-site analysis, because these methods were not used in the test case study. However, based on the description from Miles and Huberman (1994), the matrices mentioned seem to be useful for the EUNITE case studies.

With these recommendations the separate case studies that have been carried out in the EUNITE network were designed. The design and the results of these case studies considered individually is described in the next chapter.

7 Case studies within the EUNITE network

This chapter describes the design and the results of the separate case studies that have been carried out in the EUNITE network. Four universities have been visited: the Catholic University at Leuven, the Helsinki University of Technology, Lund University and the University of Twente. This chapter starts with a description of the EUNITE network and an overview of the case studies in this network and the objectives and questions of this research. Next the design of the case studies is described, including a description of the process of the collection of the data and the method of analysis. Next the results of the within-site analysis of the case studies at the four different universities are presented. This chapter concludes with a summary of the findings of the separate case studies at the four universities. The cross-site analysis of the overall EUNITE case study is presented in Chapter 8.

7.1 The EUNITE network

This section describes the EUNITE network and its relation with ICT in education and is based on the Website of EUNITE (http://www.eunite-online.org/) and the Memorandum of Understanding (EUNITE, 2000) which was signed by the rectors of the participating universities.

EUNITE is a strategic alliance of eight European universities, established in October 2000. The name stands for European University Network for Information Technology in Education. The alliance aims at:

- implementation of information and communications technologies (ICT) in teaching and learning in higher education;
- creating a cooperative network of universities;
- creating a European Virtual Campus.

In achieving these goals EUNITE wants to develop the following opportunities for co-operation:

- the innovation potential of ICT for on-campus higher education,
- new ways for open and distance learning,
- the internationalisation of learning programmes,
- enhanced inter-university networking in the provision of courses and programmes/curricula, and
- the production of learning materials.

A very important aspect of the EUNITE strategic alliance is the opportunity for participating universities to make use of each other's courses and course material, specifically through distance learning. This is the reason why its distributed virtual and multi-campus university - the European Virtual Campus - may be regarded as the main endeavour of EUNITE.

The European Virtual Campus is the technical and organisational infrastructure through which distance learning courses and materials from the EUNITE partner universities can be accessed. It is believed that online studies will be especially well suited for lifelong learners. The Virtual Campus will contain a catalogue of online offerings and instructions for registering. To join a course, the student will have to apply to the university from which the course is distributed. Each course will be classified according to the European Credit Transfer System.

The members of the EUNITE network are Aalborg Universitet (Denmark), Universidad de Granada (Spain), Fernuniversität Hagen (Germany), Helsinki University of Technology (Finland), Katholieke Universiteit Leuven (Belgium), Lund University (Sweden), University of Twente (the Netherlands), and the University of Strathclyde (Scotland).

The EUNITE network has been chosen to be the overall case study for this research. This choice is based on (a) the need to find universities that are partners in a network of universities to reach for some comparability in context with regard to using new forms of ICT in education (b) The alliance aims at the implementation of ICT in teaching and learning in higher education and (c) the fact that the University of Twente where this research is carried out is one of the partners in this network.

For this research four of the universities were chosen to be involved in the case studies. These universities are the University of Twente, the Catholic University at Leuven, the Helsinki University of Technology and Lund University. The choice for these universities has been based on the fact that they are partners in the EUNTE network, on the location of the universities (Northern Europe) and on the age of the universities (two old and two new).

7.2 Design of the case studies in the EUNITE network

This section describes the design of the case studies in the EUNITE network, based on the experiences and recommendations that came out the test case study (Chapter 6). Following the brief overview and the goals of this case study, the decisions that were made about the selection of cases and respondents is described. Next an overview is given of the decisions regarding the process of data collection and the method of analysis.

7.2.1 Overview and goals of the case study

Based on the theoretical framework presented in Chapters 2 and 3, the literature study in Chapter 5 and the decision to use a case study method to find answers to the overall research question (described in Chapter 6) a case study involving four universities in the EUNITE network was carried out. The design of the case study is based on the objective to find an answer to the overall research question and the sub Research Questions 3 to 8.

In Table 25 an overview is given of the variables used in the case studies. The complete list of variables for Chapter 7 and 8, including means and standard deviations is included in Appendix F. The file with the raw data of the case studies is included in Appendix G.

Table 25 Overview of the variables used in the EUNITE case studies

Variable	Values
Task of the respondents	Rector
	Policy advisor
	Head of department
	Support unit (educational)
	Support unit (technical)
	Support person faculty
	Instructor/researcher
	Student
Role of the respondents	Policy
	Support
	Education
University	UT (University of Twente)
	KUL (Catholic University at Leuven
	HUT (Helsinki University of Technology)
	LU (Lund University)
Form of ICT	Only an electronic learning environment
	Only Websites
	Only computer based training
	Only videoconferencing
	Combination of applications without an electronic learning environment
	Combination of applications including an electronic learning environment
Implementation scale	1. Incidental, one or more instructors
	2. Increasing awareness, at all levels
	3. Coordinated and supported activities
	4. Integrated in teaching and learning
The five OC Questions and answer alternatives (see Chapter 2, Section 2.4.3):	
Cause	Social fitness *versus* economic fitness
Constituents	Multiplicity of constituent demands *versus* dependence on institutional constituents
Content	Consistency with organisational goals *versus* discretionary constraints imposed on the organisation
Control	Coercion or enforcement *versus* voluntary diffusion of norms
Context	Environmental uncertainty *versus* environmental interconnectedness
The ICT factors (see Chapter 3, Section 3.3.7)	Indicated as important: yes or no
Profiles	Supporting learners in a changing world
	Developing expertise in the university
	Surviving in a competitive world
	Evolving to a cost-effective approach

NB: If a university uses an electronic learning environment or a course management system the term “electronic learning environment” in the variable “form of ICT” is replaced by the name of the specific system that is used at the university.

In the next section the selection of cases and respondents is discussed.

7.2.2 Selection of cases and respondents

The differences between the four universities that were chosen to be involved in the case studies (the University of Twente, the Catholic University at Leuven, the Helsinki University of Technology and Lund University) is presented in Table 26.

Table 26 Characteristics of the four universities

University	EUNITE partner	Location	Region	Age
UT	✓	the Netherlands	Dutch-Flemish	40 years
KUL	✓	Belgium	Dutch-Flemish	575 years
HUT	✓	Finland	Nordic	90 years (university status since 1908)
LU	✓	Sweden	Nordic	335 years

Within the universities a diversity of respondents was chosen in order to avoid becoming dependent on a single group of informants with a specific role. At each university the respondents were chosen according to their role in the university, ranging from instructor / researcher to support person to policy maker or rector / vice-chancellor. These categories are presented in Table 27.

Table 27 Categories of respondents in the EUNITE case study

Description of the task	Persons to be interviewed
Rector / board	Rector and/or members of the Board
Policy advisor	Members of the academic community, involved in advisory groups or working at the policy bureau
Management of faculty/department	Deans, Educational Directors and Executive Directors
Support unit (educational)	Members of an educational support unit
Support unit (technological)	Members of an technical support unit
Support person faculty/department	Educational or technical support person, employed by a faculty or department
Instructor	Instructor at the university
Student	Student at the university

The respondents per institution were selected based on the advice of a leading person in the field of ICT in education at each of the universities. These experts introduced the respondents in turn as experts and interested faculty members, divided over a number of faculties and support units. Details of each set of the respondents will be given in the separate case studies.

7.2.3 Data collection

As recommended in the results of the test case study in Chapter 6 the interview at the four universities consisted of four main components (instead of five during the test case study):

1. The first part was dedicated to the task of the respondent and his or her relation and experiences to the use of new forms of ICT in education. General information about the experiences of the respondent and the experiences of the academic unit (department, faculty, university) was the outcome of this part of the interview.
2. The second part of the interview was focused more specifically at the research questions of this study. The questions related to the factors that could be important in the decision to use ICT in education were posed.
3. During the third part of the interview the interviewer explained the ICT Factors score table and asked the respondent to mark the factors that have been important in his or her perception of the institution in relation to the use of new forms of ICT in education.
4. In the fourth part of the interview the interviewer showed the respondent the results of the literature study in relation to the five OC questions (in the form of diagrams related to the answers on the five questions as has been done in Section 5.3.2) and asked the respondent to react on these results and indicate which answer alternative for each dimension is most appropriate for his or her own context related to ICT in education.

7.2.4 Instrumentation for data collection

The ICT Factors score table that was used for the third part of the interview is included in Appendix E. To structure the interview at the universities within the EUNITE case study the interviewer used the form included in Appendix H.

7.2.5 Method of analysis (qualitative)

Chapter 6 described the method of analysis for the test case study. Based on the test case study it was decided to do both quantitative and qualitative analysis. For the within-site analyses an effects matrix and a site dynamics matrix are analysis techniques that were applied in this research.

7.2.6 Method of analysis (quantitative)

In addition to standard statistical methods such as means and frequencies that are used for the four case studies of the individual universities more advanced statistical methods will be used in the cross-site EUNITE case study. These methods are described in the next chapter, where the results of the overall case study are described.

7.2.7 Guide for the report

The report of each of the individual case studies will be structured as follows:

- General description of the university
- Overview of ICT-related aspects at the university
- Results: General information (number and roles of respondents)
- Results: Factors that influence the use of new forms of ICT
- Results: Organisational change
- Results: Profiles
- Synthesis

7.3 Results of the case study at the University of Twente

This section describes the case study at the University of Twente. A description of the university is given in Section 7.3.1 and specific issues related to ICT in education are

discussed in Section 7.3.2. Following this general information about the respondents and about the way the respondents use ICT in education with regard to form and scale is described, followed by the results of the case study in relation to the ICT factors and the organisational change issues in Sections 7.3.3-7.3.6.

7.3.1 General description of the university

This section gives a general description of the University of Twente and is primarily based on the information available on the university's Website (http://www.utwente.nl/).

The UT was established in 1961 as the *Technische Hogeschool Twente* ('Twente University of Technology'). In 1986 the name was changed to University of Twente (UT). The UT is the only campus-based university in the Netherlands; all the buildings and activities are located on one spot, the Drienerlo estate. The integration between education, research, and academic student life itself was, and still is, considered to be very important. The UT contains programmes in both technological and social sciences. Characteristic features in the vision and policy of the UT are innovativeness and entrepreneurship, as indicated in its mission statement. The UT wants to be an innovative institution for academic education and research and states itself as striving for (a) excellent quality in teaching; (b) research at an internationally recognised level, resulting in a selected number of research institutes that perform at the European top-level; (c) functional interconnectedness of engineering and social sciences; (d) significant inflow of international students; and (e) support of the economic and social developments in the Eastern part of the Netherlands. The University of Twente offers regular Master's programmes in the Dutch language in the following disciplines:

Table 28 Regular Master's programmes at the UT (Dutch language)

Regular Master's programmes	
Mechanical Engineering	Civil Engineering and Management
Electrical Engineering	Business Information Technology
Chemical Engineering	Philosophy of Science, Technology and Society
Applied Physics	Public Administration and Public Policy
Mathematical Science	Educational Science and Technology
Computer Science	Applied Communication Science

Presently students can choose from the following international Masters programmes (in English):

Table 29 International Master's programmes at the UT (English language)

International Master's programmes	
Mechatronics	Telematics Applications in Education and Training
Environmental and Energy Management	Educational and Training Systems Design
International Full-time MBA programme	Human Resources Development
International Executive MBA programme	Telematics
Fine Arts	Engineering Mathematics
Financial Engineering	Microsystems and Microelectronics Engineering
Dutch Art Institute	

Specific information about the use of new forms of ICT at the University of Twente is described in the next section.

7.3.2 New forms of ICT at the university

This section describes the plans of the University of Twente with regard to using new forms of ICT in education and is based on the most recent policy document about ICT in education (Tongeren, 1998), a document about information policy (Koppen, 2000) and a publication on the use of new forms of ICT at the UT (Fisser, & Van Geloven, 2000).

The University of Twente is seen as the university in the Netherlands with the best technological infrastructure for students and staff members and with the most intensive use of it. In 1994 the UT was the first university that gave all her students e-mail possibilities. In 1995 the CAMPUSnet was ready and since that moment all students living on campus (over 2000) have unrestricted access to the network of the university (and therefore the Internet) for a monthly contribution of Dfl. 15 (7 Euros). Students who live outside the campus can connect to the network by a dial-in connection or via cable and ADSL. In 1998 year the UT entered into a contract with the cable proprietor Castel in which it was decided that all students can access the university's network from everywhere in the Netherlands for local telephone rate. This makes it easy fort students to connect to the network, whether they are at home, at their parent's house, or at their practical training address. This provision is part of a larger deal for students. All students of the UT obtain 10 MB disk space on a central computer which can be accessed at home or at the university. The space can be used for documents, papers or even a personal homepage. This makes carrying floppy disks and notebooks from an to the university unnecessary.

The university's computer shop provides not only computers with the necessary hard-and software, it can also provide the subscription on the telephone network and it has special offers for first-year students. Three times a year there is a special PC project, in which students can buy a computer with a special reduction. When purchasing a computer students can make use of an interest-free loan that they have to pay back in 24 months. The university has a helpdesk where students can gain free support and advice when needed. Manuals for installation can be found on a website. Next to this there is a carry-in service: students can bring their computers to the helpdesk and the staff members will install everything correctly. Courses on computer-use are also available, ranging from basic courses such as MS Word and Excel to programming in C++. The costs for the students for these courses are low.

The use of new forms of ICT in education at the University of Twente started with individual instances of computer based training and evolved further to using simulations for specific domains of study, intensive use of the Internet (WWW, email), some use of the possibilities of video conferencing and a growing awareness of the possibilities that shared workspaces and groupware offer for group-based and project-based learning. To tune the needs of all departments with regard to the available applications and to bring the use of new forms of ICT in the education of the university to an even higher level, the initiative was taken by the Rector to form the Taskforce "Telematics Applications in Education" at the end of 1997. The task of the Taskforce was to develop a vision about the use of new forms of ICT in education that could be communicated throughout the university. A policy document was written (Tongeren, 1998) based on the vision of the Taskforce to stimulate

the implementation of ICT in education throughout the whole of the university. This policy document describes the vision of the University of Twente and offers some practical directives to stimulate synergy between various projects that were initiated with regard to implementing ICT in education. One of the major issues in the document was the notion that the UT does not want to become a virtual university in the sense that the UT finds it of utmost importance that 'live', face-to-face contact between instructor and student will be possible during the learning process of the student and that this contact is extended, not replaced, by technology (Carleer & Collis, 1998).

Central support for using new forms of ICT in education is an other important aspect of the policy document, especially in relation to the new educational concept of Major-minor, which was implemented throughout the university in 1999-2000. Within these plans ICT should be integrated in education as a means for improvement of the personal guidance of the student. ICT provides a tool to increase the choice possibilities for students as well as to enrich the learning process.

The use of new forms of ICT should thus support a move toward permanent individual guidance for the student. Just-in-time contact between instructor and students and among students themselves is a key factor in this way of thinking about ICT in education. The policy document describes that the instructor's role will change from lecturer in a traditional classroom situation to a guide. ICT will play a facilitating role and enables the instructor to give feedback when needed. It also gives the possibility to tailor the educational needs of different groups of students. New groups of students can be reached, such as part-time students throughout The Netherlands and foreign students. Synergy between the internationalisation policy and ICT policy is obvious.

All faculties of the university are using new forms of ICT in education. On an individual level all kinds of examples of using new forms of ICT in education can be found. An instructor who uses the World Wide Web in his education is the most apparent example, but with more and more experience instructors began to integrate more interactivity into Web environments as early as 1994, such as discussion lists, simulations and feedback possibilities (see for instance Collis, 1997a, Collis & Moonen, 2001). This grew in some cases to an adequately integrated course environment where students and instructors can communicate with each other before, during and after lectures. Both studies in social sciences and in technical sciences are using new forms of ICT applications. These applications relate often to the Internet (Webpages and e-mail), but also video conferencing and computer based training are used to support education.

In 1998 the TeleTOP project of the Faculty of Educational Science and Technology was seen throughout the university as one of the most promising large-scale projects of the university. This project had as overall goal to systematically support the professional development of the faculty in terms of potential telematics-applications in their teaching, and to carry out the re-design of all courses in the faculty so that education becomes more efficient, more enriched, and more flexible (Collis, 1997a,b;Collis, 1999; Collis & De Boer, 1999). In 1998/99 all first-year courses were re-engineered, the next year all second-year courses were re-designed. This continued until all courses were Web-supported, working within the TeleTOP system. TeleTOP was then seen as a course management system and attracted the attention of other faculties and departments in the university. The first

department which started to use TeleTOP in its education was the department of Telematics. Soon the Faculty of Electrical Engineering followed.

Because of the successful implementation at these faculties the university board decided in 1999 to choose TeleTOP as course management system for the entire university. In the year 2000 the university wide implementation started on a voluntary basis, meaning that all technical facilities were supplied by the university and a team of instructional designers was available for educational support, but is was up to the faculties to decide if, and to what extent, they wanted to join the TeleTOP implementation (Gommer & Visser, 2001). A special working group was initiated to discuss the possibility to implement TeleTOP as the campus-wide course management system. This resulted in a implementation plan in which the Development Institute for Knowledge, Education and Learning (DINKEL) was made responsible for the integration of TeleTOP throughout the university.

The objective of the university board is to have all courses implemented in TeleTOP by the year 2002. The way TeleTOP is being implemented at the various faculties differs. In general three strategies for the implementation of TeleTOP van be distinguished (Gommer & Visser, 2001):

1. Overall strategy: TeleTOP is implemented in all study phases of the faculty. The faculty chooses for an overall implementation and all instructors are expected to use TeleTOP to support their courses;
2. Phased strategy: The implementation starts in the first year of the faculty. When the first year is using TeleTOP, the system is gradually implemented into the other study-phases;
3. Pilot strategy: The faculty starts with a few pilot courses. Instructors can participate in these pilots on a voluntary basis. When the pilots prove to be successful, the implementation is expanded to one of the other strategies.

The implementation strategy is not prescribed by the university board, but is chosen by the faculty itself. For each faculty an instructional designer of the DINKEL Institute is available for support during the implementation process.

At this moment (June 2001) more than 400 courses offered at the University of Twente have been implemented in TeleTOP. The situation as of June 2001 is that all faculties have decided to participate in the TeleTOP implementation process (Gommer & Visser, 2001):

- Two faculties have already finished the complete implementation of the TeleTOP system in their education,
- Four faculties have more than 75% of their courses in TeleTOP,
- Five faculties are in the middle of a large-scale implementation process and have approximately 50% of the courses in TeleTOP, and
- Three faculties are still in the pilot-phase (approximately 25% of the courses in TeleTOP).

In relation to the implementation Gommer and Visser (2001) have made a number of observations:

- in the course environments that were analysed, the emphasis is clearly on the dissemination of information from the instructor to the students. This information is not only organisational but also content-related. In the TeleTOP environments, instructors offer students lecture notes, articles, etc.
- the TeleTOP environments are primarily used by instructors to prepare students for learning and helping them to practice and orientate on course content.
- although a lot of activity and dissemination of information is taking place in TeleTOP, some possibilities of the system are not (or not sufficiently) exploited yet.
- During the first 1.5 years of the TeleTOP implementation, instructors have put a lot of time and effort in getting to know the system and making their paper materials available in a digital format.
- An earlier evaluation study at the Faculty of Educational Technology (Collis & Messing, 2001) shows similar results.

The DINKEL Institute is now investigating how the TeleTOP system can be further elaborated. This project, named C@mpus+, aims at integrating all information systems of the campus into one system with a single log-on portal to make information access (educational and other information) even more easy and integrated for students and staff members.

Based on this context the interviews during the case study at the University of Twente were carried out. The results are presented in Sections 7.3.3 - 7.3.6.

7.3.3 Results: General information

In this section the general results are described as collected during the case studies. These general results relate to the respondents (their role in the organisation) and the way ICT is used at the university.

Respondents

At the University of Twente the following respondents were interviewed (see Table 30). The numbers in the frequency column indicate the number of respondents that were interviewed and between brackets the approximate number of possible respondents. For example: the Board of the UT consists of five members, during the case study one member of the Board was interviewed.

Table 30 Task of the respondents (UT)

	Frequency	Percent of interviewed sample
Rector / board	1 (5)	2.9
Policy advisor	4 (10)	11.8
Management of faculty/department	7 (50)	20.6
Support unit (educational)	3 (35)	8.8
Support unit (technological)	1 (100)	2.9
Support person faculty	7 (30)	20.6
Instructor	10 (1300)	29.4
Student	1 (5800)	2.9
Total respondents interviewed	34	100.0

Because of the limited number of respondents the tasks of the respondents have been combined into new categories in order to make further calculations more useful. The rector / board, policy advisors and head of faculties or departments have been combined in the role of "policy". Respondents from the educational and the technological support units and the support persons in a faculty or department have been combined in the role of "support". The instructors and the students have been combined in the role "education".

This is shown in Table 31 where it can be seen that there are approximately equal groups of respondents.

Table 31 Roles of the respondents (UT)

	Frequency	Percent of sample
Policy	12	35.3
Support	11	32.4
Education	11	32.4
Total	34	100.0

The respondents were asked to answer the interview questions to their best knowledge. If the questions related to situations in which some of the respondent had no personal experience the respondents were asked to give their perception of the overall situation of the University of Twente. For instance a question about using a particular ICT application in education cannot be answered for a specific teaching context by the respondents that fit in the category "policy". Therefore they have given their view on these questions in relation to the whole university context.

Use of new forms of ICT
At the University of Twente the TeleTOP system is heavily used. There were five respondents that indicated that TeleTOP is used as the only means to support education (usually in addition to the regular lectures). This result has to be refined, because of the reason mentioned above related to the role of the respondent. This is shown in Table 32. Two of the five respondents who indicated that they use TeleTOP as the only means to support education are categorised in the role "education". The other three respondents were persons from the category "support". There was only one respondent (an instructor) that indicated that he uses a self-made Website. One of the respondents (also an instructor) uses a combination of applications (without TeleTOP). This includes discipline-specific applications such as MathCAD and simulations.

The other 27 respondents indicated that a combination of TeleTOP and other ICT applications (simulations, cbt-programmes, etc.) is being used in education. Examining how this is distributed over the roles of the respondents it can be seen that all policy advisors indicated this (and were thus commenting about the university as a whole), 8 of the 11 support persons indicated it and 7 of the 11 respondents in the category education indicated a combination of ICT applications including TeleTOP as the main form of ICT that is used in education.

Table 32 New form of ICT per role of the respondent (UT)

Form of ICT	Roles of the respondents			
	Percent of sample Policy	Percent of sample Support	Percent of sample Education	Group Total
Only the electronic learning environment TeleTOP	0	8.8	5.9	14.7
Only Websites	0	0	2.9	2.9
Only computer based training	0	0	0	0
Only videoconferencing	0	0	0	0
Combination of applications	0	0	2.9	2.9
Combination of applications incl. TeleTOP	35.3	23.5	20.6	79.4
Group Total	35.3	32.4	32.4	100.0

The scale of the implementation

In addition to the form of ICT that is used the scale of the implementation of ICT at the University of Twente was examined. This resulted in the results shown in Table 33 and shows that the majority of the respondents (20 out of 34) indicate that the activities related to ICT in education are coordinated and supported. The other 14 respondents go even further, they indicate that the use of new forms of ICT has been integrated in education. Looking at the distribution of the answers of the respondents in relation to their role at the university it can be seen in Table 33 that the answers are approximately equally divided.

Table 33 Implementation scale (UT)

	Roles of the respondents			
	Policy	Support	Education	Group Total
1. Incidental, one or more instructors	0	0	0	0
2. Increasing awareness, at all levels	0	0	0	0
3. Coordinated and supported activities	8	7	5	20
4. Integrated in teaching and learning	4	4	6	14
Total	12	11	11	34

This section presented general information about the respondents, the way ICT is used in an educational context and the scale on which ICT is implemented. In the next section more information is given about the factors that influence the use of new forms of ICT at the University of Twente.

7.3.4 Results: Factors that influence the use of new forms of ICT

In this section the research question “Which factors effect change processes in universities with regard to using new forms of ICT in education?” is addressed. From the interviews and the ICT Factors score table (see Appendix E) the following list of ICT factors indicated as influencing the use of new forms of ICT in education at the University of Twente can be presented in descending order in Table 34.

Table 34 ICT factors (UT) (n=34)

	Number of times the factor is indicated as important		Number of times the factor is indicated as important
Availability facilities	30	Leadership	12
Availability technology	28	New market	11
Flexibility	25	Response to threats and opportunities	11
Educational and technical support	25	Demands from learners	11
Administrative support	24	Broad participation	11
Active learning	23	Partnerships	10
New technology (push, hype)	21	Tailor-made products	9
Emerging technology	20	(new) organisational structure	9
New conceptions of learning	20	Cost-effectiveness	9
Part-time students	19	Funding	8
Improved access to education	18	Changing student demographics	8
New teaching models	18	Concrete plans	8
Benefits	15	on-demand training	7
Competition	14	Dependence on it	7
Focus on learner/learning	14	Knowledge management	6
Individual differences	14	Demands from employers	6
Lifelong learning	13	Education as business	3
Dynamic environment	12	Reducing costs	2
Shared vision	12		

Looking at Table 34, it can be seen that two-thirds of the respondents indicate that the availability of facilities, the availability of technology, impulses for flexibility, educational and technical support, administrative support and a commitment to active learning are the most important reasons to use ICT in education at the University of Twente. Other factors that are also important (according to more than 50 percent of the respondents) are new technology (push, hype), emerging technology, new conceptions of learning, part-time students, improved access to education and new teaching models. From this it can be concluded that the category “support facilities” is very important at the University of Twente. Environmental pressures, technology developments and educational developments are also important, but less frequently mentioned. Institutional conditions and cost-effectiveness considerations are of least importance according to these results.

In the next section the results of the five organisational change questions are given.

7.3.5 Results: Organisational change

In addition to the ICT factors the five OC questions as presented in Chapter 4, Section 4.1 were used to address the research question. The respondents were asked to answer these questions in relation to the specific context of the University of Twente. Table 35 shows the overview of the answers of the respondents to the five questions. After the table a description of the answers per question is given.

Table 35 Organisational change (UT)

OC question and answer dimension	Frequency (total, n=34)	Percent of sample	Roles of the respondents: Policy (n=12)	Support (n=11)	Education (n=11)
Cause: Social	21	62%	75%	45%	64%
Cause: Economic	13	38%	25%	55%	36%
Constituents: Multiplicity	2	6%	0%	9%	9%
Constituents: Institutional	32	94%	100%	91%	91%
Content: Consistency	13	38%	50%	45%	18%
Content: Constraints	21	62%	50%	55%	82%
Control: Coercion	22	65%	50%	82%	64%
Control: Voluntary	12	35%	50%	18%	36%
Context: Uncertainty	23	68%	58%	55%	91%
Context: Interconnectedness	11	32%	42%	45%	9%

The cause of change
The first question about the cause of the change was coded on the dimensions of legitimacy or social fitness and efficiency or economic fitness. About 60 percent of the respondents indicated that there has been a socially motivated reason to use ICT in education. Common used phrases to explain this were “to enhance the quality of education” and “to support students in their learning process”. Both policy and education persons have high scores on the social dimension. On the economical dimension it can be seen that 55 percent of the respondents gave an economical reason for using new forms of ICT in education at the UT. To attract and support more students was the most common explanation for choosing an economic reason to use ICT, but also time and place flexibility was seen as an economic reason. The support persons had the highest scores on these dimensions.

The constituents of change
For the constituents of change answer categories were “multiplicity of constituent demands” and “dependence on institutional constituents”. During the interviews this was interpreted as internal versus external involvement in the decision to use ICT in education. From the interviews at the University of Twente it appears that there was almost no pressure from external persons or organisations. The two respondents who did indicate this mentioned a national and a European project that steered the use of new forms of ICT in education because of certain demands that had to be met during these projects. In general the use of new forms of ICT has been stimulated by institutional constituents. Even though it has been the case that there have been multiple institutional constituents involved (for instance in the case of using TeleTOP throughout a faculty) the respondents felt that this was an internal situation and they did not feel pressured from the outside.

The content of change
For the question about the content of change the answer categories were “consistency with organisational goals” and “discretionary constraints imposed on the organisation”. These answer categories were interpreted as whether using new forms of ICT has brought a change in the way education is delivered or not. About 40 percent of the respondents indicated that there is no change in the way that education is given compared to previous way of

delivering education. But almost all of these respondents state that this is only a starting phase. After the instructors have learned how to use ICT effectively in education (including managing and reducing the technical problems) the respondents expect that education will change, especially related to the role of the instructor and to the possibility to offer more flexibility. More than 60 percent of the respondents indicate that there has been a shift already from earlier ways to offer education. Looking at the different roles of the respondents it can be seen in Table 35 that there is a discrepancy within two groups of respondents: the policy persons and the support persons have different perceptions about the concept of the change. The education group however is less divided, 9 of the 11 respondents indicate that ICT has brought a change in the way education is delivered.

The control of change
The fourth OC question is concerned with the control of the change. For the control of the change the answer categories were "coercion or enforcement" and "voluntary diffusion of norms". Almost two-thirds of the respondents say that they have perceived some kind of coercion to use ICT in education. In most cases this has been some form of stimulation and support from the support person within the faculty, but for instance at the faculty of Educational Science and Technology it has been enforcement from the management of the faculty: all instructors have to use TeleTOP as a means to support their education. Fifty percent of the policy persons indicate that some form of coercion has been enforced. The scores for the support persons and the persons with an education role are higher: 9 out of 11 support persons indicate that there has been enforcement and 7 out of 11 persons in the education group perceived some form of enforcement.

The context of change
Finally, the answer categories for the context of the change were "environmental uncertainty" and "environmental interconnectedness". About 30 percent of the respondents feel that the context of their faculty or university is reasonably certain, they do not expect much difference in the near future. The other respondents indicated that they feel that the context of the faculty or university is uncertain. They are mainly concerned with diminishing student numbers and budget and with possible future re-organisation activities of the university. However, most of these respondents indicate that ICT will have just a minor role in solving this uncertainty. As can be seen in Table 35 the instructors are the persons that have the highest perception of an unstable environment.

7.3.6 Results: Profiles

In Chapter 5 (describing the literature study) four profiles of universities in change processes involving ICT were outlined. If the responses of the respondents of the University of Twente are coded according to these results Table 36 can be presented.

Table 36 Profiles (UT)

	Frequency	Percent of sample	Roles of the respondents Percent of sample Policy (n=12)	Percent of sample Support (n=11)	Percent of sample Education (n=11)
1. Supporting learners in a changing world	14	41	33	27	64
2. Developing expertise in the university	7	21	42	18	0
3. Surviving in a competitive world	9	27	25	27	27
4. Evolving to a cost-effective approach in education	4	12	0	27	9
Total	34	100	100	100	100

From these results it can be seen that most of the respondents can be placed in the profile "Supporting learners in a changing world". Especially the persons in the role of education seem to fit best in this profile (64%). The policy persons prefer the second profile, "developing expertise in the university". Support persons do not seem to have a preference to one specific profile. The profile "Evolving to a cost-effective approach in education" seems to be the least interesting overall profile for the respondents of the University of Twente.

It is possible to analyse which of the ICT factors are specifically interesting for each profile. Table 37 indicates which factors per profile were mentioned as important by at least 50 percent of the respondents categorised in the profiles.

Table 37 ICT Factors per profile (UT)

(✔ if 50% or more of the respondents choosing the profile also chose the factor)

Factors	Profile 1 Supporting learners in a changing world (n=14)	Profile 2 developing expertise in the university (n=7)	Profile 3 Surviving in a competitive world (n=9)	Profile 4 Evolving to a cost-effective approach (n=4)
Flexibility	✔	✔	✔	✔
Emerging technology	✔	✔	✔	✔
Active learning	✔	✔	✔	✔
Administrative support	✔	✔	✔	✔
Availability technology	✔	✔	✔	✔
Availability facilities	✔	✔	✔	✔
New conceptions of learning	✔	✔	✔	
New teaching models	✔	✔	✔	
Improved access to education	✔		✔	✔
Benefits	✔		✔	✔
Educational and technical support	✔		✔	✔
New technology (push, hype)		✔	✔	✔

Table 37 continues…

Table 37 (continued)

Broad participation		✓	✓	
Focus on learner/learning		✓	✓	
Individual differences		✓	✓	
Leadership		✓		✓
Part-time students			✓	✓
Partnerships		✓		
Competition		✓		
Cost-effectiveness		✓		
New market			✓	
Lifelong learning			✓	
Dynamic environment			✓	
Changing student demographics			✓	
Demands from learners			✓	
New organisational structure			✓	
Funding				✓
Shared vision				✓
Reducing costs				✓

From the table it can be seen that there are six ICT factors that are common for all the profiles, indicated in the upper grey cells. These factors are flexibility, emerging technology, active learning, administrative support, availability technology and availability facilities. There are also factors that appear in three different profiles (new conceptions of learning, new teaching models, improved access to education, benefits, educational and technical support).

A distinction between the profiles can be made if the factors that can only be placed in one or two profiles are further examined (indicated in the lower grey cells). It seems that broad participation, focus on learner/learning and individual differences are specifically fitted into Profiles 2 and 3. Leadership is fitted into Profiles 2 and 4 and part-time students in Profiles 3 and 4.

Partnerships, competition and cost-effectiveness are the two factors that fit specifically in Profile 2. There are more factors that are only mentioned for Profile 3: new market, lifelong learning, dynamic environment, changing student demographics, demands from learners and new organisational structure. Funding, shared vision and reducing costs appear only in Profile 4. There are no factors in this table that are mentioned only once or twice in Profile 1.

7.3.7 Relation of the four profiles and the implementation of new forms of ICT

The relation between the four profiles with which the respondents of the university are associated are combined with the form of ICT that has been chosen and the level of implementation. The results of this analysis is presented in Table 38.

Table 38 Combining the four profiles and the implementation of new forms of ICT (UT)

New form of ICT	Implementation scale	Percentage of implementation scale in Profile 1	Percentage of implementation scale in Profile 2	Percentage of implementation scale in Profile 3	Percentage of implementation scale in Profile 4
Only the electronic learning environment TeleTOP	coordinated and supported activities	0	100	0	0
	integrated in teaching and learning	25	0	50	25
Only Websites	coordinated and supported activities	0	0	0	100
Combination of applications	Coordinated and supported activities	100	0	0	0
Combination of applications including TeleTOP	Coordinated and supported activities	40	30	18	12
	Integrated in teaching and learning	50	10	40	0

From Table 38 it can be seen that the coordinated and supported activities to implement TeleTOP as the only means to support education are associated with Profile 2. Bringing the implementation of TeleTOP to a higher level seems to related to Profile 3 in 50 percent of the cases, and to the Profiles 1 and 4 in the other cases. This could indicate that in order to integrate TeleTOP in teaching and learning economic motives are very important in the decision to use TeleTOP, in combination with a primarily unstable environment. Combining other ICT applications with TeleTOP a different picture can be seen. For coordinated and supported implementation activities Profiles 1 and 2 seem to be the associated profiles, but this moves to the Profiles 1 and 3 when the ICT applications and TeleTOP are integrated in the teaching and learning process this. From this it may be concluded that the characteristics of Profile 1 (a social motive to use new forms of ICT in education and an uncertain environment) are the most important issues to consider if the UT wants to fully integrate ICT in teaching and learning.

7.3.8 Synthesis

Summarising the results of the previous sections the following observations can be made:

- It appears that the University of Twente is indeed influenced by each of the factor categories. All factors were mentioned at least twice. The availability of support facilities at the University of Twente is seen as the most important category of factors (mentioned by 30 out of 34 respondents). Without the support facilities (technological and personal) it is not seen as possible to implement new forms of ICT on a large-scale basis. Most of the respondents indicate that there are sufficient support facilities available. Each faculty has its own educational and ICT support person, sometimes combined in one staff member. In addition to these faculty staff members the faculty can

call upon the expertise of the DINKEL Institute for educational / pedagogical / didactical support and on the CIV (Centre for Information Services) for technical support. The only issue that concerns the respondents are the facilities in the regular lecture halls. All new halls are equipped with network connection, computers and projection beamers, but not all the older rooms have these facilities.

- The respondents at the University of Twente are also responsive to environmental pressures, technology developments and educational developments. Flexibility in time and place for both students and instructors scores high on the lists. This in combination with part-time students, improved access to education and new conceptions of learning and new teaching models leads to a shift in education away from supporting regular students only toward supporting a more-diverse group of students such as part-timers and masters students. According to the respondents, the push to use new technology is probably influenced by the research institutes that concentrate heavily on ICT and because of the emphasis that is put on ICT by the Board of the University, which wants to profile the UT as an ICT university.
- Looking at the five OC questions related to the cause, the constituents, the content, the control and the context of using new forms of ICT in education it is reasonable to describe the tendencies at the UT as: there is a social reason to use ICT, the implementation of ICT is mainly steered by internal UT persons, using new forms of ICT has changed the way education is offered, the implementation of ICT has been carried out under some kind of enforcement and the context of the university is uncertain, but this has probably little to do with ICT.
- With regard to the profiles, about 40 percent of the respondents can be placed in Profile 1 (supporting learners in a changing world). The other respondents are in the other three profiles, where Profile 4 (evolving to a cost-effective approach) seems to be the least favourite (12 %).
- The ICT factors that are important in all four profiles are flexibility, emerging technology, active learning, administrative support, availability technology and availability facilities. Profile 1 has no factors that are mentioned only in this profile. Profile 2 distinguishes itself from the others by the factors partnerships, competition and cost-effectiveness. Profile 3 distinguishes itself from the others by the factors new market, lifelong learning, dynamic environment, changing student demographics, demands from learners and new organisational structure. Funding, shared vision and reducing costs appear only in Profile 4.

Comparing the profiles of the UT with those as described in Chapter 5 (Section 5.4) there are differences and similarities between the factors that were found for each profile compared to the factors per profile in the case study at the University of Twente These results are presented in Table 39were the checks show which variables were indicated as important in the profiles of the literature study and those variables that were indicated as important in the profiles of the UT.

Table 39 Differences in differentiating factors per profile (literature - UT)

	Profile 1 (lit.)	Profile 1 (UT)	Profile 2 (lit.)	Profile 2 (UT)	Profile 3 (lit.)	Profile 3 (UT)	Profile 4 (lit.)	Profile 4 (UT)
Partnerships				✓				
Competition				✓				
Cost-effectiveness				✓				
New market						✓		
Lifelong learning					✓	✓		
Dynamic environment						✓		
Changing student demographics					✓	✓		
Demands from learners					✓	✓		
New organisational structure						✓		
Funding								✓
Shared vision			✓					✓
Reducing costs								✓
Active learning			✓					
Leadership							✓	

In both the literature study and the case study at the UT there were no real distinguishing factors (the factors that are only mentioned in one of the profiles) found for Profile 1. The factors that were common for each of the profiles in the literature study included three factors from the educational developments category. For the UT there are no factors from the educational developments category mentioned as specifically distinguishing for Profile 1, but they are mentioned in the Profiles 1, 2 and 3.

The factors for Profile 2 in the literature study were shared vision and active learning. At the UT there is a difference: the distinguishing factors are partnerships, competition and cost-effectiveness. Profile 3 stayed more or less the same, new market and new organisational structure are added. Profile 4 changed: funding, shared vision and reducing costs are more important than leadership.

In the next section the case study at the Catholic University at Leuven is described. The results of the case study at the University of Twente compared with the other case studies will be described in Section 7.7.

7.4 Results of the case study at the Catholic University at Leuven

This section describes the case study at the Catholic University at Leuven (K.U. Leuven). A description of the university is given in Section 7.4.1 and specific issues related to ICT in education are discussed in Section 7.4.2. Following this general information about the respondents and about the way the respondents use ICT in education with regard to form and scale is described, followed by the results of the case study in relation to the ICT factors and the organisational change issues in Sections 7.4.3-7.4.6.

7.4.1 General description of the university

This section gives a general description of the K.U. Leuven and is primarily based on the information available on the university's Website (http://www.kuleuven.ac.be/).

Founded in 1425, the K.U. Leuven is a Flemish University of Catholic signature with an international orientation. It has the legal statute of private institution. The university's teaching is based on its own research and its interdisciplinary approach. The university aims at transferring knowledge through high quality interdisciplinary scientific teaching. Its programmes attempt to integrate professional training into a broad ethical, cultural and social context of education. Rather than passing on mere factual knowledge, it aims to promote the skills of identifying, formulating and solving problems. Special attention is paid to the steady evaluation of its teaching with the aims to enhance the student's capacity for independent study, to provide intensive individual guidance and an adequate evaluation system, to ensure high didactic qualities of the teaching staff and the use of new teaching methods and technologies.

The university has over 26000 students (with approximately 8 % of foreign origin), about 4600 professors and researchers, 2500 administrative and technical staff and 7000 university hospital staff. There are three campuses in Leuven: Humanities, Biomedic sciences and Exact sciences all three on different locations.

The K.U. Leuven's undergraduate programmes contribute to an as broad as possible participation of Flemish young people. At the same time the K.U. Leuven continuously directs itself towards new target groups. It also offers doctoral studies and postgraduate programmes in a number of fields. Although the K.U. Leuven is an independent and privately run institution, the academic programmes and diplomas are fully accredited by the Flemish Government. Under the Flemish decree governing university education, the academic programmes are structured into the different levels of education. The categories of academic programmes are (a) basic academic programmes, (b) advanced academic programmes, (c) medical specialisations, (d) doctorate programmes and (e) university continuing education.

The basic academic programme is divided into a first cycle and a second cycle. The first cycle, a 'kandidatuur' (candidature) programme, usually takes two years. The second cycle takes two or three years and offers a more specialised training and competence within a chosen field. The advanced academic programmes provide training at a graduate level. They are aimed at students who already possess a basic academic degree, or a foreign diploma of academic education based on a minimum length of three years of study and regarded as equivalent by the academic authorities. In the Faculty of Medicine, specialisation is possible in almost all fields of medicine and dentistry. The programmes are organised in the form of on-the-job-training, by combining a post as medical assistant in the University hospitals with a further training in the chosen domain.

Various institutes and departments of the university organise lectures, seminars, congresses and summer schools within the concept of lifelong learning. Because the topics of these continuing education offerings differ from one year to another, and because programmes related to these offerings are organised in flexible ways, it is not really possible to give a concrete list of activities. In Table 40 all faculties of K.U. Leuven are presented.

Table 40 Faculties at the K.U. Leuven

Group Humanities	Group Biomedical Sciences	Group Exact Sciences
Faculty of Theology	Faculty of Medicine	Faculty of Science
Faculty of Canon Law	Faculty of Pharmaceutical Sciences	Faculty of Engineering
Institute of Philosophy	Faculty of Physical Education and Physiotherapy	Faculty of Agricultural and Applied Biological Sciences
Faculty of Law		
Faculty of Economics and Applied Economics		
Faculty of Social Sciences		
Faculty of Arts		
Faculty of Psychology and Educational Sciences		

Besides education and research, the K.U. Leuven has other tasks of service to society. The university puts its knowledge at the disposal of public authorities, organisations and industry. Its concern for public health is realised in the university hospitals. On the basis of its research it aims to support permanent education of its graduates in their professional lives. In 1965 the K.U. Leuven founded a campus in Kortrijk. This campus has not been included in this study, only the three main campuses that are based in Leuven have been included.

7.4.2 New forms of ICT at the university

This section describes the ICT-related activities of the K.U. Leuven and is primarily based on the information of the Websites from K.U. Leuven (http://www.kuleuven.ac.be/) and EuroPACE (http://www.europace.be/).

K.U. Leuven students and staff members can make use of different computer and network services offered by LUDIT (the university's service centre for computers and telematics) at K.U. Leuven. One of the services offered is KotNet. The KotNet-project has as a goal to offer as many students and members of the personnel as possible, the chance to connect from their homes or from their "kot" (student residences) to the Internet. Entrance fee and usage costs are kept as low as possible. Besides this the university aims at wide Internet-access, both in terms of bandwidth and applications. To achieve this goal there have been negotiations with several "suppliers-partners" to get the best conditions. The KotNet is accessible by cable modem, modem / ISDN (dial-up or dialin) and via connection in the residences: through the permanent connection in the student's rooms in the cabled student residences, it is possible the get very fast network connectivity. In the Summer of 2000 50 student residences and 3800 student rooms were connected to KotNet. In practice this means that there were 5200 students and 620 staff members connected at home to the Internet via cable modem and 1100 students and 1300 staff members were connected at home through an ISDN connection.

The Board of the University is advised on ICT-related issues via the advice group "Information and Communication Technology in Education". This group has been established to give advice with regard to (a) support for ICT projects at the university, (b)

infrastructure questions, (c) stimulating innovation projects and (d) training and supporting new staff members in relation to ICT in education.

One of the service units of the university, DUO (University Education Unit), has a team of staff members that are assigned to support staff members who want to use ICT in education. This team offers support in designing, developing and producing ICT-related activities and products. This support can be of a educational of technical nature. There is also support for specific media-related questions. This support is offered in co-operation with the Audiovisual Service Unit (AVdienst). This unit also co-operates with LINOV and EuroPACE if the projects are involved in international projects.

The Leuven Institute for Innovative Learning (LINOV) was established in 1994 as a unit to stimulate and support the expertise of the university with regard to ICT-supported education and distance education and for the implementation of ICT-supported education at different levels of the university. Since the academic year 1999-2000 LINOV has concentrated itself on the promotion and support of activities related to using new forms of ICT for the internationalisation of education. This has been done by working together with the faculties and support units on several ICT projects. In addition to this LINOV supports the activities of the K.U. Leuven in which international organisational networks for ICT-supported (distance) education are carried out. Two of the most important networks are EuroPACE 2000 and EUNITE. EUNITE has been described in Section 7.1, EuroPACE 2000 is described here briefly.

EuroPACE is a trans-European network of universities and their partners in education and training (URL: http://www.europace.be/). Approximately 60 member organisations (45 of them universities) participate in this network throughout Europe. Through the use of different models EuroPACE strives to demonstrate and develop the potential of telematics for the European university of the future and thus aims to contribute to the realisation of the concept of lifelong learning.

Based on this information the interviews during the case study at the K.U. Leuven were carried out. The results are presented in Sections 7.4.3 - 7.4.6.

7.4.3 Results: General information

In this section the general results are described as collected during the case study. These general results relate to the respondents (their role in the organisation) and the way ICT is used at the university.

Respondents

At the K.U. Leuven 17 respondents were interviewed (see Table 41). The numbers in the frequency column indicate the number of respondents that were interviewed and between brackets the approximate number of possible respondents. For example: the Board of the KUL consist of four members; during the case study one member of the Board was interviewed. No number of possible respondents has been filled in for the category “support person faculty”. This is due to the fact that most support persons in the faculties have no official function as support person, but carry this task out in addition to their regular tasks. From Table 41 it seems that no one from a technological support unit was interviewed, but

one of the policy advisors is head of the unit Information & Communication Technology & Systems, therefore it can be established that this part of the university has been covered.

Table 41 Task of the respondents (KUL)

	Frequency	Percent of interviewed sample
Rector / board	1 (4)	5.9
Policy advisor	2 (10)	11.8
Management of faculty/department	2 (17)	11.8
Support unit (Educational)	5 (10)	29.4
Support unit (technological)	0 (30)	0
Support person faculty	5 (…)	29.4
Instructor	2 (4600)	11.8
Student	0	0
Total	17 ()	100.0

In the same way as has been done for the case at the University of Twente the tasks of the respondents have been combined into new categories in order to make further calculations more useful. The rector / board, policy advisors and head of faculties or departments have been combined in the role of "policy". Respondents from the educational and the technological support units and the support persons in a faculty or department have been combined in the role of "support". The instructors and the students have been combined in the role "education". This is presented in Table 42.

Table 42 Roles of the respondents (KUL)

	Frequency	Percent of sample
Policy	5	29.4
Support	10	58.8
Education	2	11.8
Total	17	100.0

The respondents were asked to answer the interview questions to their best knowledge. If the questions related to situations in which some of the respondent has no personal experience the respondents were asked to give their perception of the overall view of the K.U. Leuven. For instance a question about using a particular ICT application in education cannot be answered for a specific teaching context by a respondent in the category "policy". Therefore they gave their view in relation to the whole university context.

Use of new forms of ICT

Two of the forms of ICT that are used at the K.U. Leuven are described here in more detail: the use of videoconferencing at the Medical Faculty and Ariadne.

At the beginning of the 1998-1999 academic year the Faculty of Medicine launched the Pentalfa project. This is a project for continuing postgraduate medical education. From a centrally located, newly set up auditorium at the Gasthuisberg university hospital, weekly interactive postgraduate lectures are received at four remote sites in different parts of Flanders. This interactive lectures included discussions between a panel of specialists with an audience of medical doctors.

The ARIADNE project (1996-2000) addressed infrastructural aspects, trying to establish an integrated platform for large-scale authoring, sharing, reuse and delivery of educational material. One of the aspects of ARIADNE is that it promotes "share and reuse" across organisational boundaries: in order to achieve share and reuse, a critical mass of good quality material is required (Cardinaels et al, 1998). The aim is to support management, search and evaluation of such objects, without forcing the end user to manually browse all the objects, or to identify the few nuggets of value in a desert of inappropriate "hits" returned by a general-purpose Web search engine (Forte, Wentland-Forte & Duval, 1997a,b). The process of storing and retrieving educational material (or learning objects) is described at the Website of ARIADNE (http://ariadne.unil.ch/) as:

- "Authors creating new pedagogic material with specific authoring tools and by reusing existing material, retrieved from the Knowledge Pool System (KPS, a distributed database of reusable pedagogical documents) and then segmented and recomposed ;
- Faculty or Trainers indexing their pedagogic documents and storing them into the KPS Repository;
- Pedagogic Engineers creating or modifying courses, using the curriculum editor , alone or in collaboration;
- Course Managers, administering their course with the ad-hoc functions of the ARIADNE system;
- Knowledge Pool Administrators, using the KPS administrative and technical function set; and finally
- Learners of the mentioned categories, following KPS based curricula, thanks to the individualised and up-to-date view provided by the ARIADNE Learner Interface".

The respondents indicated that at the K.U. Leuven a combination of applications is the form of ICT that is used by the majority of staff members. This combination includes self-made Websites, Websites that are developed by the ICT team of the DUO unit and subject specific applications (simulations and computer programmes). Two of the respondents (instructors) indicate that they use only Websites as a means to support their education. Two other respondents indicate that they use the ARIADNE system and one of the respondents uses video conferencing to support educational activities. In Table 43 the new forms of ICT at the K.U. Leuven are presented.

Table 43 New form of ICT per role of the respondent (KUL)

New form of ICT	Roles of the respondents			Group Total
	Percent of sample Policy (n=5)	Percent of sample Support (n=10)	Percent of sample Instructors (n=2)	
Only the electronic learning environment ARIADNE	0	0	0	0
Only Websites	5.9	5.9	0	11.8
Only computer based training	0	0	0	0
Only videoconferencing	5.9	0	0	5.9
Combination of applications	17.6	41.2	11.8	70.6
Combination of applications incl. ARIADNE	0	11.8	0	11.8
Group Total	29.4	58.8	11.8	100

From Table 43 it can be seen that ARIADNE is not widely used at the K.U. Leuven, only 2 respondents (11.8%) from the support group indicated that Ariadne is used by some of the staff members at K.U. Leuven, but that the system is mainly used for European projects.

The scale of the implementation
The respondents provided information about the scale of implementation of ICT at the K.U. Leuven. This is presented in Table 44.

Table 44 Implementation scale (KUL)

	Roles of the respondents			
	Policy	Support	Education	Group Total
1. Incidental, one or more instructors	1	1	0	2
2. Increasing awareness, at all levels	2	6	2	10
3. Coordinated and supported activities	2	3	0	5
4. Integrated in teaching and learning	0	0	0	0
Total	5	10	2	17

As can be seen from Table 44 the respondents indicated that there is an increasing awareness of the possibilities of ICT in education at the K.U. Leuven. The support persons are the most resolute about this. In some cases the respondents indicated that there is coordinated and supported activities within the universities to support the implementation of ICT in education, but there are no persons from the education group that indicated this. None of the respondents said that ICT is fully integrated in the teaching and learning process at this university.

This section presented general information about the respondents, the way new forms of ICT are used in an educational context and the scale on which these new forms are implemented. In the next section more information is given about the factors that influence the use of new forms of ICT at the K.U. Leuven.

7.4.4 Results: Factors that influence the use of new forms of ICT

In this section the research question “Which factors effect change processes in universities with regard to using new forms of ICT in education at the K.U. Leuven?” is addressed. From the interviews and the ICT Factors score table (see Appendix E) the following list of ICT factors indicated as influencing the use of new forms of ICT in education at the K.U. Leuven can be presented in descending order in Table 45.

Table 45 ICT factors (KUL) (n=17)

	Number of times the factor is indicated as important		Number of times the factor is indicated as important
New conceptions of learning	15	On-demand training	7
Shared vision	12	Part-time students	6
Active learning	12	Demands from employers	6
Flexibility	11	Demands from learners	6
Benefits	11	New technology (push, hype)	6
Availability technology	11	Individual differences	6
Lifelong learning	10	New market	5
Educational and technical support	10	Dynamic environment	5
Changing student demographics	9	Leadership	5
Broad participation	9	Cost-effectiveness	5
Concrete plans	9	Administrative support	5
Improved access to education	9	Competition	4
New teaching models	9	Dependence on IT	4
Partnerships	8	Tailor-made products	3
Emerging technology	8	Knowledge management	3
Focus on learner/learning	8	(new) organisational structure	3
Availability facilities	8	Funding	2
Education as business	7	Reducing costs	0
Response to threats and opportunities	7		

From Table 45 it can be seen that factors related to educational developments, environmental pressures (especially related to the needs of students) and the availability of facilities is important according to the respondents of K.U. Leuven. Also, having a shared vision scores high. Issues related to cost-effectiveness and reducing cost and environmental pressures related to issues such as competition and funding have a minor role according to the respondents.

In the next section the results of the five organisational change questions are given.

7.4.5 Results: Organisational change

In addition to the ICT factors the five organisational change questions as presented in Chapter 4, Section 4.2 were used to address the research question. The respondents were asked to answer these questions in relation to the specific context of the K.U. Leuven. Table 46 shows the overview of the answers of the respondents to the five questions. After the table a description of the answers per question is given.

Table 46 Organisational change (KUL)

			Roles of the respondents		
OC question and answer dimension	Frequency (total, n=17)	Percent of sample	Percent of sample Policy (n=5)	Percent of sample Support (n=10)	Percent of sample Education (n=2)
Cause: Social	14	82	60	100	50
Cause: Economic	3	18	40	0	50
Constituents: Multiplicity	6	35	40	30	50
Constituents: Institutional	11	65	60	70	50
Content: Consistency	5	29	40	10	100
Content: Constraints	12	71	60	90	0
Control: Coercion	0	0	0	0	0
Control: Voluntary	17	100	100	100	100
Context: Uncertainty	7	41	40	40	50
Context: Interconnectedness	10	59	60	60	50

The cause of change
The first question about the cause of the change was coded on the alternatives of legitimacy or social fitness and efficiency or economic fitness. The majority of the respondents (82%) indicated that a social motivation to use and support new forms of ICT in education is most important. This relates at the K.U. Leuven to enhancing the quality of education and to link the use of new forms of ICT with an educational concept called “guided self-study”. In this concept it is expected that students are capable to steer their own learning process in an efficient way. Students have to know how to find and interpret domain specific knowledge and how to solve domain specific problems. The possibilities of new forms of ICT are seen as possibilities to support this process. The 3 (out of 17) respondents who indicated that there is an economic reason to use ICT referred to possible gains in time and effort to develop and support a course and to attracting a new student population.

The constituents of change
For the question about the constituents of the change answer categories were “multiplicity of constituent demands” and “dependence on institutional constituents”. During the interviews this was interpreted as internal versus external involvement in the decision to use new forms of ICT in education. 65 % of the respondents indicated that at the K.U. Leuven institutional constituents are the primary source of influence on supporting new forms of ICT in education. In general these are the enthusiastic instructors and support persons that promote the use of new forms of ICT by developing their own Websites and projects. In addition to these individual projects there are some university-wide projects that have been initiated by the Advice group “Information and Communication Technology in Education”.

In Table 46 it can be seen that 35 % of the respondents indicate that there has been some external involvement in the decision to use new forms of ICT in education. This involvement relates primarily to projects with European partners and in the case of the medical faculty to the Pentalfa project, the project for continuing postgraduate medical education. In the Pentalfa project the faculty works together with medical specialists throughout Belgium, meeting their training needs.

The content of change
For the question about the content of the change the answer alternatives were "consistency with organisational goals" and "discretionary constraints imposed on the organisation". These answer categories were interpreted as whether using new forms of ICT has brought a change in the way education is delivered or not. About 70% of the respondents indicated that supporting some new form of ICT in education means that the way that education is delivered and supported has changed at the K.U. Leuven. This is especially noted by the support persons. Again this relates to the link of using new forms of ICT and the educational concept of guided self-study. Students are encouraged to be more and more independent in their educational processes corresponding to their stages in that learning process. The younger student receives more guidance than the older student. The respondents that indicated that there has been no difference in the way the learning material has been taught (30%) ascribe this to the fact that instructors first have to learn how to use the technology in education before they can implement it usefully.

The control of change
There was complete consensus in the answers of the respondents on the fourth question, related to the control of the change. For the control of the change the answer categories were "coercion or enforcement" and "voluntary diffusion of norms". All of the respondents say that there has not been any coercion or enforcement to use new forms of ICT in education. Most of the respondents expect that this will not change in the future.

The context of change
The answer categories for the final question about the context of the change were "environmental uncertainty" and "environmental interconnectedness". On this question the answers of the respondents are strongly distributed. Forty-one percent of the respondents indicate that they perceive the environment of the university or their faculty as uncertain or unstable whereas 59% say that the environment is relatively stable. The respondents indicating uncertainty in the environment refer to diminishing student numbers, cuts in the budget and increasing competition with other universities. As can be seen in Table 46 here is also a strong distribution within the three groups of respondents on the context of the change.

7.4.6 Results: Profiles

In Chapter 5 (describing the literature study) four profiles of universities in change processes involving ICT were outlined. In this section this is repeated for the K.U. Leuven and presented in Table 47.

Table 47 Profiles (KUL)

	Frequency	Percent of sample	Roles of the respondents Policy (n=5)	Support (n=10)	Education (n=2)
1. Supporting learners in a changing world	5	29.4	1	4	0
2. Developing expertise in the university	9	52.9	2	6	1
3. Surviving in a competitive world	2	11.8	1	0	1
4. Evolving to a cost-effective approach in education	1	5.9	1	0	0
Total	17	100.0	5	10	2

From Table 47 it can be seen that the two profiles that relate to a social motive (Profiles 1 and 2) have the highest scores and that Profile 2, developing expertise in the university, fits the answers of the respondents best. This means, according to the description of this profile in Chapter 5, Section 5.4, that social reasons for using new forms of ICT in education and the fact that the environment around the organisation (university, department, etc) are interconnected. The changing profile of the student is important. To examine if this description of Profile 2 is confirmed by the findings of the case study at K.U. Leuven and consequently to analyse which of the ICT factors are specifically interesting for each profile at this university Table 48 is presented which indicates which factors per profile were mentioned as important by at least 50 percent of the respondents categorised in the profiles.

Table 48 ICT Factors per profile (KUL)

(✔ if 50% or more of the respondents choosing the profile also chose the factor)

ICT Factors	Profile 1 Supporting learners in a changing world (n=5)	Profile 2 developing expertise in the university (n=9)	Profile 3 Surviving in a competitive world (n=2)	Profile 4 Evolving to a cost-effective approach (n=1)
Lifelong learning	✔	✔	✔	✔
Flexibility	✔	✔	✔	✔
Broad participation	✔	✔	✔	✔
Shared vision	✔	✔	✔	✔
Concrete plans	✔	✔	✔	✔
New conceptions of learning	✔	✔	✔	✔
Educational and technical support	✔	✔	✔	✔
Availability technology	✔	✔	✔	✔
New teaching models	✔	✔	✔	
Active learning	✔	✔	✔	
Emerging technology	✔	✔	✔	
Availability facilities	✔	✔	✔	
Benefits	✔	✔		✔
Partnerships	✔		✔	✔
Improved access to education	✔		✔	✔

Table 48 continues…

Table 48 (continued)

Changing student demographics		✓	✓	✓
New technology (push, hype)	✓	✓		
Focus on learner/learning	✓	✓		
Response to threats and opportunities	✓		✓	
Dependence on IT	✓		✓	
Cost-effectiveness	✓		✓	
ICT Factors	*Profile 1*	*Profile 2*	*Profile 3*	*Profile 4*
Leadership	✓			✓
On-demand training		✓	✓	
Demands from learners			✓	✓
Education as business			✓	✓
Dynamic environment	✓			
Administrative support		✓		
Part-time students			✓	
Competition			✓	
Demands from employers			✓	
Individual differences			✓	
New market				✓
Knowledge management				✓

From Table 48 it can be seen that there are 8 ICT factors that are common for all the profiles, indicated in the upper grey cells. These factors are lifelong learning, flexibility, broad participation, shared vision, concrete plans, new conceptions of learning, educational and technical support and availability technology. There are also factors that appear in three different profiles (new teaching models, active learning, emerging technology, availability facilities, benefits, partnerships, improved access to education and changing student demographics).

A distinction between the profiles can be made if the factors that can only be placed in one of the profiles are further examined (indicated in the lower grey cells). It seems that dynamic environment is specifically important for Profile 1 and administrative support is the only factor that is only mentioned in Profile 2. Profile 3 has four factors that are distinguishing for this profile: part-time students, competition, demands from employers and individual differences. For Profile 4 new market and knowledge management are characteristic factors.

7.4.7 Relation of the four profiles and the implementation of new forms of ICT

The relation between the four profiles with which the respondents of the university are associated are combined with the form of ICT that has been chosen and the level of implementation. The results of this analysis is presented in Table 49.

Table 49 Combining the four profiles and the implementation of new forms of ICT (KUL)

New form of ICT	Level of implementation	Percentage of implementation scale in Profile 1 (n=5)	Percentage of implementation scale in Profile 2 (n=9)	Percentage of implementation scale in Profile 3 (n=2)	Percentage of implementation scale in Profile 4 (n=1)
Only Websites	incidental, one or more teachers	100	0	0	0
	increasing awareness, at all levels	0	0	100	0
Only videoconferencing	incidental, one or more teachers	0	0	0	100
Combination of applications	increasing awareness, at all levels	33	56	11	0
	coordinated and supported activities	33	67	0	0
Combination of applications including ARIADNE	coordinated and supported activities	0	100	0	0

From Table 49 it can be seen that using only Websites in education at an incidental level only relates to Profile 1. The use of Websites at the level of increasing awareness is associated with Profile 3. Incidental videoconferencing is associated with Profile 4. More interesting are the results for the use of a combination of applications and the combination of applications including ARIADNE. Both categories of new forms of ICT are primarily related with Profile 2. This could mean that if the reasons to use these new forms are social and the environment of the university is certain/stable, the likelihood of implementing these forms of ICT is high at the K.U. Leuven.

7.4.8 Synthesis

Summarising the results of the previous sections the following observations can be made:

- At the K.U. Leuven a combination of ICT applications is used. This includes not only individual Websites, but also domain-specific tools, videoconferencing and the ARIADNE system. From the answers of the respondents it can be concluded that there is an increasing awareness of the possibilities of ICT in education at all levels of the university and that it is possible for instructors to get coordinated support activities for the implementation of ICT from central support units.
- Factors that are categorised under “educational developments” play a major role in supporting the use of new forms of ICT, especially related to the concept of guided self-study, where the student is more and more responsible for his or her own learning process. Active learning, new teaching models and a focus on the learner and the learning process are the most important factors in relation to the educational concept at K.U. Leuven. Having a shared vision and concrete plans is also important at the university. Again, the concept of guided self-study plays a major role. This concept is

implemented throughout the university and increases the notion of a shared vision. Broad participation is seen as a consequence of this. The role of ICT in the educational concept is a supporting role. The respondents indicate that there have to be enough facilities to accomplish this. A factor that has not been mentioned by the respondents of the K.U. Leuven is using new forms of ICT in education in order to reduce the costs.

- Looking at the five organisational change questions related to the cause, the constituents, the content, the control and the context of using new forms of ICT in education the tendencies can be described as: there is primarily a social motive to use new forms of ICT in education, the majority of the persons that have been involved in supporting new forms of ICT in education are from the university itself, but there are projects in which other external partners are involved, using new forms of ICT has brought a change in the way education is offered and supported, ICT has been implemented in education on a voluntary basis. The context of the university is perceived as both stable as uncertain; and there is an equal distribution of the answers from the respondents. However, the respondents that indicated that the environment of the university or faculty is unstable stated that ICT can offer some possibilities to limit the uncertainties in relation to supporting new groups of students.
- From the answers of the respondents it appears that Profile 2, "developing expertise in the university" is the most suitable profile for K.U. Leuven (53%), possibly in combination with Profile 1, "supporting learners in a changing world" (30%).
- The factors that are important in all four profiles are lifelong learning, flexibility, broad participation, shared vision, concrete plans, new conceptions of learning, educational and technical support, availability technology. Dynamic environment is specifically important for Profile 1 and administrative support is the only factor that is only mentioned in Profile 2. Profile 3 has four factors that are distinguishing for this profile: part-time students, competition, demands from employers and individual differences. For Profile 4 new market and knowledge management are characteristic factors.

Comparing the profiles of the K.U. Leuven with those as described in Chapter 5 (Section 5.4) there are differences and similarities between the factors that were found for each profile from the literature study compared to the factors per profile in the case study at the K.U. Leuven. In the literature study there were no real distinguishing factors (the factors that are only mentioned in one of the profiles) found for Profile 1. For the K.U. Leuven dynamic environment was found as a differentiating factor. For Profile 2 there is a shift from shared vision and active learning towards having administrative support. Profile 3 has not really changed in the category of factors that is important. This has remained to be environmental pressures. But there is a shift from demand from learners towards demands from employers and the factors competition and accounting for individual differences is added. The factors in Profile 4 changed from leadership to new market and knowledge management.

These results are presented in Table 50 were the checks show which variables were indicated as important and differentiating in the profiles of the literature study and those variables that were indicated as important in the profiles of the K.U. Leuven.

Table 50 Differences in differentiating factors per profile (literature - KUL)

	Profile 1 (lit.)	Profile 1 (KUL)	Profile 2 (lit.)	Profile 2 (KUL)	Profile 3 (lit.)	Profile 3 (KUL)	Profile 4 (lit.)	Profile 4 (KUL)
Dynamic environment		✓						
Shared vision			✓					
Active learning			✓					
Administrative support				✓				
Lifelong learning					✓			
Changing student demographics					✓			
Demands from learners					✓			
Part-time students						✓		
Competition						✓		
Demands from employers						✓		
Individual differences						✓		
Leadership							✓	
New market								✓
Knowledge management								✓

In the next section the case study at the Helsinki University of Technology is described. The results of the case study at the K.U. Leuven compared with the other case studies will be described in Section 7.7.

7.5 Results of the case study at the Helsinki University of Technology

This section describes the case study at the Helsinki University of Technology. A description of the university is given in Section 7.5.1 and specific issues related to new forms of ICT in education are discussed in Section 7.5.2. Following this general information about the respondents and about the way the respondents use new forms of ICT in education with regard to form and scale is described, followed by the results of the case study in relation to the ICT factors and the organisational change issues in Sections 7.5.3-7.5.6.

7.5.1 General description of the university

This section gives a general description of the Helsinki University of Technology and is primarily based on the information available on the university's Website (http://www.hut.fi/).

The Helsinki University of Technology Founded in 1849, received its university status in 1908. In accordance with the general objective set for universities, HUT aims at an internationally high level of research and teaching, specialises in its strengths, and supports the emergence of centres of expertise in research and teaching. HUT has set itself the aim of being one of the top ten universities of technology in Europe by 2005.

The university has 12 faculties, 9 separate institutes, 16 degree programmes, 224 professors and approximately 13800 under- and postgraduate students. In 2000 869 Masters´ degrees

and 90 doctorates were awarded. The Master level degrees offered by Helsinki University of Technology are Master of Science in Technology, Master of Science in Architecture and Master of Science in Landscape Architecture. The instruction of the degree programmes is organised in such a manner that it is possible for a student to graduate in five years (Masters' degree). However, since no defined amount of studies is bound to any particular year, the average time required for graduation is considerably longer: for the Master of Science in Technology it is over 7 years and for the Master of Science in Architecture almost 10 years. The main reason for the prolonged studying time is the fact that many students work part-time during their studies. In Table 51 the 12 faculties at the Helsinki University of Technology are listed.

Table 51 Faculties at the HUT

Faculties at the HUT	
Automation and Systems Technology	Chemical Technology
Engineering Physics and Mathematics	Materials Science and Rock Engineering
Computer Science and Engineering	Forest Products Technology
Industrial Engineering and Management	Architecture
Electrical and Communications Engineering	Surveying
Mechanical Engineering	Civil and Environmental Engineering

Helsinki University of Technology offers nine international study programmes (see Table 52).

Table 52 International study programmes at HUT

International study programmes
Modern Technology in the Pulp and Paper Industry and New Printing Technology
Industrial Enterprise of the Future (Framtidens Industriföretag)
International Business Linkage Programme
Infocom Management Programme
International Architecture Program
International Project-oriented Business
European Mining Course
Master's Programme in Electrical Engineering
Master's Programme in Telecommunications

The Helsinki University of Technology is required by the government to co-operate with research institutions and trade and industry, aiming to increase technological and scientific competence both within the University and outside it, and to improve the prospects of trade and industry and of society as a whole through research and teaching based on this research. Related to this the mission of HUT is to engage in scientific research in order to "help mankind to control issues related to global trends and development needs, such as environmental change, food and energy procurement, health care, migration and population growth".

7.5.2 New forms of ICT at the university

This section describes the ICT-related activities of the Helsinki University of Technology and is primarily based on the information of the Website from the HUT (http://www.hut.fi/),

the Website of the University's unit Computing Resources (http://www.hut.fi/cc/) and the Website of the Lifelong Learning Institute Dipoli (http://www.dipoli.hut.fi/).

The Helsinki University of Technology offers several possibilities for students and instructors to use new forms of ICT in education. With regard to computer facilities the Computing Centre provides computer services for study, teaching, research and administration. The Computing Centre at HUT is a service unit and an administratively separate department. Its users or clients are primarily people at the University (students and staff). The main services provided by the Computing Centre are:

- opportunities for independent use of multi-user computers,
- opportunities for the use of general computer software,
- client facilities with terminals and other equipment,
- telecommunications within the University and to the outside world,
- written instructions and manuals on how to use equipment and software,
- selling PC software under various university licences,
- providing guidance and expert assistance both in the use of these services and more generally with computer problems as far as possible, and
- providing various units in the University with assistance.

In addition to the provision of facilities and materials instructors can be supported by the Lifelong Learning Institute Dipoli if they want to implement new forms of ICT in education. HUT Dipoli provides professional continuing training and development training in technology and related fields. In co-operation with HUT experts it helps organisations and individuals develop their competence by producing training, development and lifelong learning services. The main products of Dipoli are long-term training programmes and development projects. The objective is to meet the educational and development needs. Distance learning and working, computer aided teaching, videoconferencing, cable television and other ICT services are objects of training programmes.
Based on this overview the interviews during the case study at the Helsinki University of Technology were carried out. The results are presented in Sections 7.5.3-7.5.6.

7.5.3 Results: General information

In this section the general results are described as collected during the case study. These general results relate to the respondents (their role in the organisation) and the way new forms of ICT are used at the university.

At the Helsinki University of Technology the following respondents were interviewed (see Table 53). The numbers in the frequency column indicate the number of respondents that were interviewed and between brackets the approximate number of possible respondents. For example: the Board of the HUT consist of three members, during the case study one member of the Board was interviewed. No number of possible respondents has been filled in for the category "support person faculty". This is due to the fact that most support persons in the faculties have no official function of support person, but carry this task out in addition to their regular tasks. As can be seen in Table 53 in addition to the support persons from different faculties several educational support persons from Dipoli were interviewed.

Table 53 Task of the respondent (HUT) (n=18)

	Frequency	Percent of sample
Rector / Board	1 (3)	5.6
Policy advisor	2 (10)	11.1
Head of faculty/department	3 (12)	16.7
Support unit (Educational)	2 (25)	11.1
Support unit (Technical)	0	0
Support person faculty	4 (…)	22.2
Instructor	4 (224)	22.2
Student	2 (13800)	11.1
Total	18	100.0

As has been done in the other case studies the tasks of the respondents have been combined into new categories in order to make further calculations more useful. The rector / board, policy advisors and head of faculties or departments have been combined in the role of "policy". Respondents from the educational and the technological support units and the support persons in a faculty or department have been combined in the role of "support". The instructors and the students have been combined in the role "education". This is presented in Table 54.

Table 54 Roles of the respondents (HUT) (n=18)

	Frequency	Percent of sample
Policy	6	33.3
Support	6	33.3
Education	6	33.3
Total	18	100.0

The respondents were asked to answer the interview questions to their best knowledge. If the questions related to situations in which some of the respondent have no personal experience the respondents were asked to give their perception of the overall situation at the Helsinki University of Technology. For instance a question about using a particular ICT application in education cannot be answered for a specific teaching context by the respondent in the category "policy". Therefore they gave their views in relation to the whole university context.

In relation to the new forms of ICT that is used at the Helsinki University of Technology 17 of the 18 respondents indicated that a combination of applications is used at the university. This combination includes the use of self-made Websites of the instructors, e-mail, computer-based training and domain-specific simulations and computer programmes. One of the respondents (an instructor) said that he makes of computer based training to support his education, especially designed for his domain of research. The results with regard to the form of ICT that is supported at HUT is presented in Table 55.

Table 55 Form of ICT per role of the respondent (HUT) (n=18)

New form of ICT	Roles of the respondents			Group Total
	Percent of sample Policy (n=6)	Percent of sample Support (n=6)	Percent of sample Education (n=6)	
Only an electronic learning environment	0	0	0	0
Only Websites	0	0	0	0
Only computer based training	0	0	5.6	5.6
Only videoconferencing	0	0	0	0
Combination of applications	33.3	33.3	27.8	94.4
Combination of applications incl. an electronic learning environment	0	0	0	0
Group Total	33.3	33.3	33.3	100.0

The majority of the respondents (67%) indicated that there are coordinated and supported activities to guide the implementation of new forms of ICT at the faculties and departments. The Computing Centre and Dipoli play an important role in these activities. Only one of the respondents indicated that using and supporting ICT in education is an incidental event, 5 of the 18 respondents say that there is an increasing awareness at all levels of the university and none of the respondents state that ICT has been fully integrated in the teaching and learning process. This is presented in Table 56.

Table 56 Implementation scale (HUT) (n=18)

	Roles of the respondents			
	Policy (n=6)	Support (n=6)	Education (n=6)	Group Total
1. Incidental, one or more instructors	1	0	0	1
2. Increasing awareness, at all levels	0	2	3	5
3. Coordinated and supported activities	5	4	3	12
4. Integrated in teaching and learning	0	0	0	0

This section presented general information about the respondents, the way ICT is used in an educational context and the scale on which ICT is implemented. In the next section more information is given about the factors that influence the use of new forms of ICT at the Helsinki University of Technology.

7.5.4 Results: Factors that influence the use of new forms of ICT

In this section the research question “Which factors effect change processes in universities with regard to using new forms of ICT in education?” is addressed for the Helsinki University of Technology. From the interviews and the ICT Factors score table (see Appendix E) the following list of ICT factors indicated as influencing the use of new forms of ICT in education at the Helsinki University of Technology can be presented in descending order in Table 57.

Table 57 ICT factors (HUT) (n=18)

ICT factors	Number of times the factor is indicated as important	ICT factors	Number of times the factor is indicated as important
New conceptions of learning	14	Partnerships	8
New teaching models	14	Competition	8
Active learning	13	Demands from employers	7
Part-time students	12	New technology (push, hype)	7
Flexibility	12	Shared vision	7
Demands from learners	12	Response to threats and opportunities	6
Focus on learner/learning	12	Changing student demographics	6
Dynamic environment	11	(New) organisational structure	6
Availability technology	11	Individual differences	6
Availability facilities	11	Administrative support	6
Lifelong learning	10	New market	4
Dependence on IT	10	Knowledge management	4
Broad participation	10	Leadership	4
Cost-effectiveness	10	On-demand training	3
Emerging technology	9	Concrete plans	3
Improved access to education	9	Reducing costs	3
Benefits	9	Education as business	2
Educational and technical support	9	Tailor-made products	2
Funding	8		

From Table 57 it can be seen that three factors that are related to educational developments have the highest scores. These are new conceptions of learning, new teaching models and active learning. Also factors with high scores are factors within the category of environmental pressures and are primarily student-related, such as “demands from learners” and “lifelong learning”. Factors related to the availability of facilities and support are also seen as important by the respondents. Cost-effectiveness and gaining benefits (financial, but also more intangible aspects such as motivation) score high as well, they are mentioned by at least 50% of the respondents. However, reducing the costs of education by using new forms of ICT in education is mentioned only three times. Other factors that does not seem to be of major importance at HUT are factors such as tailor-made products and on-demand training.

In the next section the results related to organisational change and the five organisational change questions are given.

7.5.5 Results: Organisational change

In addition to the ICT factors the five OC questions as presented in Chapter 4, Section 4.2 were used to address the research question. The respondents were asked to answer these questions in relation to the specific context of the Helsinki University of Technology. Table 58 shows the overview of the answers of the respondents to the five questions. After the table a description of the answers per question is given.

Table 58 Organisational change (HUT)

OC question and answer dimension	Frequency (total, n=18)	Percent of sample	Roles of the respondents: Percent of sample Policy (n=6)	Percent of sample Support (n=6)	Percent of sample Education (n=6)
Cause: Social	14	78	100	83	50
Cause: Economic	4	22	0	17	50
Constituents: Multiplicity	2	11	0	0	33
Constituents: Institutional	16	89	100	100	67
Content: Consistency	14	78	83	67	83
Content: Constraints	4	22	17	33	17
Control: Coercion	1	6	17	0	0
Control: Voluntary	17	94	83	100	100
Context: Uncertainty	10	56	50	67	50
Context: Interconnectedness	8	44	50	33	50

The cause of change

The first question about the cause of the change was coded on the dimensions of legitimacy or social fitness and efficiency or economic fitness. About 78% of the respondents indicated that at the HUT there is a social motive to support new forms of ICT in education. These motives relate to in the first place to supporting the student in his or her learning process. This has as consequence, according to the respondents, that the quality of education is increased. Another reason that is given for the use of new forms of ICT in education is that the HUT wants to prepare its students for the labour market, especially in the area of Helsinki there are many companies that need graduates that have ICT skills. The 22% of the respondents that indicated economic reasons refer to the diminishing student numbers and the possibility to attract new students if education is supported by new forms of ICT.

The constituents of change

For the question about the constituents of the change answer categories were “multiplicity of constituent demands” and “dependence on institutional constituents”. During the interviews this was interpreted as internal versus external involvement in the decision to use new forms of ICT in education Almost 90% of the respondents indicate that supporting new forms of ICT in education has been done under the influence of staff members of the university itself. They are making their own Websites and for more advanced ICT applications they can get support from one of the support units or from support staff at the faculty. Two of the respondents indicated that there has been external involvement. In both instances this involved a highly advanced computer programme that was developed in co-operation with companies.

The content of change

For the question about the content of the change the answer categories were “consistency with organisational goals” and “discretionary constraints imposed on the organisation”. These answer categories were interpreted as whether using new forms of ICT has brought a change in the way education is delivered or not. Almost 80% of the respondents said that there has not been a change in the way education is offered since ICT was used to support

the teaching and learning process. The other respondents indicated that there has been a change and this related in general to more flexibility for students to work at home and use e-mail to communicate with the instructors.

The control of change
The fourth OC question is concerned with the control of the change. For the control of the change the answer categories were "coercion or enforcement" and "voluntary diffusion of norms". There was only one respondent that indicated that there has been enforcement to use new forms of ICT in education. This respondent is the head of one of the departments and stated that everyone should use at least e-mail and that all course information had been described on a Webpage, because she felt that a department or university cannot do without ICT anymore. The other respondents indicated that using or supporting the use of new forms of ICT in education is a decision that is made voluntarily by each instructor him or herself.

The context of change
The answer categories for the final question about the context of the change were "environmental uncertainty" and "environmental interconnectedness". The answers by the respondents on this question resulted in 56% of the respondents indicating that the environment of the university, faculty or department is uncertain and 44% of the respondents indicating that this environment is reasonably stable. The respondents indicating that the environment is unstable referred to diminishing student numbers and the fact that companies are attracting students who are not yet graduated (because of the tight labour market). For a university such as the HUT that gets its funding based on the number of graduates this is a substantial uncertainty.

7.5.6 Results: Profiles

In Chapter 5 (describing the literature study) four profiles of universities in change processes involving ICT were outlined. In this section this is repeated for the Helsinki University of Technology and presented in Table 59.

Table 59 Profiles (HUT) (n=18)

			Roles of the respondents		
	Frequency	Percent of sample	Policy (n=6)	Support (n=6)	Education (n=6)
1. Supporting learners in a changing world	8	44.4	3	3	2
2. Developing expertise in the university	6	33.3	3	2	1
3. Surviving in a competitive world	2	11.1	0	1	1
4. Evolving to a cost-effective approach in education	2	11.1	0	0	2
Total	18	100.0	6	6	6

From Table 59 it can be seen that the Profiles 1 and 2 have the most counts, 44% of the respondents fit in Profile 1 and 33% in Profile 2. The Profiles 3 and 4 contain both 11% of the respondents. As had been done for the University of Twente and the K.U. Leuven Table 60 presents which factors per profile were mentioned as important by at least 50 percent of the respondents categorised in the profiles.

Table 60 ICT Factors per profile (HUT)

(✔ if 50% or more of the respondents choosing the profile also chose the factor)

ICT Factors	Profile 1 Supporting learners in a changing world (n=8)	Profile 2 developing expertise in the university (n=6)	Profile 3 Surviving in a competitive world (n=2)	Profile 4 Evolving to a cost-effective approach (n=2)
Dynamic environment	✔	✔	✔	✔
Dependence on IT	✔	✔	✔	✔
Focus on learner/learning	✔	✔	✔	✔
Active learning	✔	✔	✔	✔
Cost-effectiveness	✔	✔	✔	✔
Availability facilities	✔	✔	✔	✔
Part-time students	✔	✔	✔	
Broad participation	✔	✔	✔	
Improved access to education	✔	✔	✔	
New conceptions of learning	✔	✔	✔	
New teaching models	✔	✔	✔	
Benefits	✔	✔	✔	
Lifelong learning	✔	✔		✔
Funding	✔		✔	✔
Flexibility	✔		✔	✔
Shared vision	✔		✔	✔
Availability technology	✔		✔	✔
Demands from learners	✔	✔		
Partnerships	✔		✔	
Response to threats and opportunities	✔		✔	
Emerging technology	✔		✔	
New organisational structure	✔			✔
Competition		✔	✔	
New technology (push, hype)		✔	✔	
Reducing costs		✔		✔
Administrative support			✔	✔
Demands from employers	✔			
Educational and technical support	✔			
On-demand training			✔	
Changing student demographics			✔	
Individual differences			✔	
Knowledge management				✔

From Table 60 it can be seen that there are six factors that are common for each profile. These factors are dynamic environment, dependence on IT, focus on learner/learning, active learning, cost-effectiveness and the availability of facilities as indicated in the upper grey cells.

A distinction between the profiles can be made if the factors that can only be placed in one of the profiles are further examined (indicated in the lower grey cells). It seems that demands from employers and educational and technical support are specifically important for Profile 1. There are no real distinguishing factors for Profile 2. Profile 3 has three factors that are important for differentiating this profile: on-demand training, changing student demographics and individual differences. For Profile 4 knowledge management is the distinguishing factor.

7.5.7 Relation of the four profiles and the implementation of new forms of ICT

The relation between the four profiles with which the respondents of the university are associated are combined with the form of ICT that has been chosen and the level of implementation. The results of this analysis is presented in Table 61.

Table 61 Combining the four profiles and the implementation of new forms of ICT (HUT)

New form of ICT	Level of Implementation	Percentage of implementation scale in Profile 1	Percentage of implementation scale in Profile 2	Percentage of implementation scale in Profile 3	Percentage of implementation scale in Profile 4
Only computer-based training	Increasing awareness, at all levels	100	0	0	0
Combination of applications	Incidental, one or more teachers	0	100	0	0
	Increasing awareness, at all levels	75	25	0	0
	Coordinated and supported activities	33	33	17	17

From Table 61 it can be seen that if at the HUT only computer-based training is used by instructors in such a way that there is an increased awareness of the possibilities of this form of ICT, the characteristics of Profile 1 (social motive to use ICT and an uncertain environment) are probably important. An incidental implementation of the combination of applications is associated with Profile 2 and the increased awareness of the possibilities of the ICT applications primarily with Profile 1 The coordinated and supported activities to implement the combination of ICT applications are divided over the four profiles. Profiles 1 and 2 seem to be the profiles that are best associated with this level of implementation. Because of the distribution of the results a clear conclusion cannot be drawn. It seems as if the HUT wants to go to a higher level of implementation the dimensions of Profile 1 are the most important ones, a social motive to use ICT in education in an uncertain environment.

7.5.8 Synthesis

Summarising the results of the previous sections the following observations can be made:

- At the Helsinki University of Technology a combination of applications is used. This combination includes self-made Websites of the instructors, e-mail, computer-based training and domain-specific simulations and computer programmes. There is an

increasing awareness of the possibilities of new forms of ICT in education and the implementation of these ICT applications are supported by coordinated activities.
- There are three factors that are related to educational developments have the highest scores in the list of factors that are indicated as most important reasons to use ICT in education. These three factors are new conceptions of learning, new teaching models and active learning. Factors within the category of environmental pressures that are student-related and factors related to the availability of facilities and support are also seen as important by the respondents. reducing the costs of education by using new forms of ICT and factors such as tailor-made products and on-demand training are of minor importance.
- Looking at the five OC questions related to the cause, the constituents, the content, the control and the context of using new forms of ICT in education the tendencies can be described as: there is primarily a social motive to use ICT in education, the majority of the persons that have been involved in supporting ICT in education are from the university itself, using new forms of ICT has not brought a major change in the way education is offered and supported and ICT has been implemented in education on a voluntary basis. The context of the university is perceived as both stable and uncertain.
- From the answers of the respondents it appears that Profiles 1 and 2, "supporting learners in a changing world" and "developing expertise in the university" are the most suitable profile for the Helsinki University of Technology (44% and 33%).
- The factors that are important in all four profiles are dynamic environment, dependence on IT, focus on learner/learning, active learning, cost-effectiveness and the availability of facilities. The factors demands from employers and educational and technical support are specifically important for Profile 1. There are no distinguishing factors for Profile 2. Profile 3 has three factors that are important to distinguish this profile: on-demand training, changing student demographics and individual differences. For Profile 4 knowledge management is the distinguishing factor.

Comparing the profiles of the Helsinki University of Technology with those described in the literature study in Chapter 5 (Section 5.4) there are differences and similarities between the factors that were found for each profile in the literature study compared to the factors per profile in the case study at the HUT. In the literature study there were no distinguishing factors (the factors that are only mentioned in one of the profiles) found for Profile 1. For the HUT demands from employers and educational and technical support were found as distinguishing factors. In the literature study shared vision and active learning were factors that are of importance for Profile 2, but no factors were found in the case study at HUT that are only mentioned in this profile. Profile 3 has changed from changing student demographics, lifelong learning and demands from learners in the literature study to changing student demographics, on-demand training and individual difference in the HUT case study. The factor in Profile 4 changed from leadership to knowledge management. These results are presented in Table 62 were the checks show which variables were indicated as important and differentiating in the profiles of the literature study and those variables that were indicated as important and differentiating in the profiles of the HUT.

Table 62 Differences in differentiating factors per profile (literature - HUT)

	Profile 1 (lit.)	Profile 1 (HUT)	Profile 2 (lit.)	Profile 2 (HUT)	Profile 3 (lit.)	Profile 3 (HUT)	Profile 4 (lit.)	Profile 4 (HUT)
Demands from employers		✓						
Educational and technical support		✓						
Shared vision			✓					
Active learning			✓					
Lifelong learning					✓			
Changing student demographics					✓	✓		
Demands from learners					✓			
On-demand training						✓		
Individual differences						✓		
Leadership							✓	
Knowledge management								✓

In the next section the case study at Lund University is described. The results of the case study at the Helsinki University of Technology compared with the other case studies will be described in Section 7.7.

7.6 Results of the case study at Lund University

This section describes the case study at Lund University. A description of the university is given in Section 7.6.1 and specific issues related to ICT in education are discussed in Section 7.6.2. Following this general information about the respondents and about the way the respondents use ICT in education with regard to form and scale is described, followed by the results of the case study in relation to the ICT factors and the organisational change issues in Sections 7.6.3-7.6.6.

7.6.1 General description of the university

This section gives a general description of Lund University and is primarily based on the information available on the university's Website (http://www.lu.se/).

Lund University, with seven faculties and a number of research centres and specialised institutes, is the largest unit for research and higher education in Sweden. The main part of the university is situated in Lund, but a number of departments for research and education are located in Malmö and Helsingborg. Lund University was founded in 1666, partly in order to bring the provinces which had been ceded by Denmark in 1658 closer to Sweden. Since then, the University has developed into a "modern international centre for research and higher education". At present, more than 34 000 students are enrolled at Lund University and altogether some 6000 people are employed, 1570 are professors and lecturers and 1120 are other instructors & researchers. Lund University is divided into seven faculties, presented in Table 63.

Table 63 Faculties at Lund University

Faculties at Lund University
Lund Institute of Technology
Faculty of Science
Faculty of Law
Faculty of Social Sciences
Faculty of Medicine
Faculties of Arts and Theology
Malmö Academies of Performing Arts

The University has substantial freedom with regard to courses and their content, the organisation of the University, and other matters. The University also has the right to establish chairs and appoint professors. Once the Board has made the overall decisions on the budget, financial allocations, policy, and strategies, it is the responsibility of the faculty boards and departments to implement them in the day-to-day activities of the University. Lund University collaborates with many universities all over the world. Through various agreements, such as the European Socrates programme, the university sends out about 1,000 students annually and receives the same number. The University gives more than 200 courses and several master's programmes in English. These master's programmes are listed in Table 64.

Table 64 Master's programmes at Lund University

Master's programmes at Lund University
Master Programme in International Human Rights Law
Master Programme on Human Rights and Intellectual Property
Master of European Affairs Programme
Master's Programme in Evironmental Management and Policy
LUMES - an International Master's Programme in Environmental Science
Master's Programme in East and Southeast Asian Studies
Master's Programme in Urban Housing Management
European Master's Degree in Linguistics

In addition, Lund University is part of the Öresund University, along with ten other institutes of higher education in Skåne and Sjælland. Öresund University is a collaborative body whose aim is to further strengthen the development of knowledge in the Öresund region.

7.6.2 New forms of ICT at the university

This section describes the ICT-related activities of Lund University and is primarily based on the information of the Websites from the university (http://www.lu.se/) and the Website of the Centre for Information Technology in Education (http://www.citu.lu.se/)

The purpose of the Centre for Information Technology in Education (CITU) is to increase the use of information and communication technology in teaching and learning at Lund University. Since its beginning in 1995, CITU's main target groups have been the University's students and instructors. CITU aims for a close link between education and technology. The activities of CITU consist of:

- "Initiate and participate in various ICT-related educational projects
- Participate in the University's quality management work
- Develop and assess computer-based educational tools suitable for flexible, computer-aided education
- Organise and hold various IT courses
- Organising seminars concerning ICT in education, i.e. how information and communication technology can be used in teaching and learning.
- Supplying training and guidance to the University instructors in the area of flexible education with ICT.
- Develop and assess educational applications and IT systems, Web sites, etc.
- Develop support tools and resources for instructors as well as students within the area of flexible computer-aided education
- Supplying and develop technical resources, tools, and applications that simplify the use of net-based teaching.
- Supplying technical support specific for students via e-mail and by telephone during weekdays".

The focus for CITU's training program is the use of new forms of ICT in teaching as a support for students in the learning process. Especially notable about CITU's courses is that developments and improvements in ICT for educational purposes that the instructors are introduced to are incorporated in the flexible teaching methods and Web-based course material.

To accomplish this CITU has personnel with educational and technical backgrounds and is equipped with a video conference studio, an IT workshop equipped with facilities needed to produce teaching material, multi-media presentations, and posters and a teaching facility with 12 workstations (6 Macs & 6 PCs).

CITU maintains and provides two tools for education that may be used freely within the university:

- *LUVIT*, Lund University Virtual Interactive Tool. The University's Web-based course tool (or electronic learning environment).
- *e-Val Online Evaluation Tool*, a Web-based evaluation tool which via a simple interface creates surveys and questionnaires for evaluating processes, courses, and other educational events and quickly summarises data diagrammatically and in list form.

LUVIT is Lund University's Web-based system for online courses. It is an interactive learning environment for entirely or partially Web-based courses. LUVIT may be used freely for courses at Lund University. LUVIT has the following functions:

- Publication of documents;
- Communication, such as e-mail, chat-rooms, discussion forums, newsletters and online messages;
- Administration of courses, course participants, and groups.

Without any special technical knowledge, an instructor can build a course structure, administer a course and its participants, publish a document and specify access rights, and

create chatrooms and Weblinks. LUVIT is platform independent, but requires Netscape or Internet Explorer and access to Internet. The original version of LUVIT was developed at Lund University in collaboration with the company Resco AB. The system is now maintained and developed by LUVIT AB in collaboration with Icon Medialab Syd AB. LUVIT AB also handles the marketing of the LUVIT to universities and colleges, companies, and other organisations outside of Lund University.

CITU and the university's computing centre are at the present time building up a common LUVIT organisation at the University. The main objective will be to co-ordinate and secure continuous operation, support, education, and future development of LUVIT within the University.
Based on this information the interviews during the case study at Lund University were carried out. The results are presented in Sections 7.6.3-7.6.6.

7.6.3 Results: General information

In this section the general results are described as collected during the case study. These general results relate to the respondents (their role in the organisation) and the way new forms of ICT are used at the university.
At Lund University 19 respondents were interviewed (see Table 65). The numbers in the frequency column indicate the number of respondents that were interviewed and between brackets the approximate number of possible respondents. For example: the Rectorate of LU consists of three members, during the case study one member of the Board was interviewed. No number of possible respondents has been filled in for the category "support person faculty". This is due to the fact that most support persons in the faculties have no official function of support person, but carry this task out in addition to their regular tasks. As can be seen in Table 65 in addition to the faculty's support persons several educational and technological support persons from CITU were interviewed.

Table 65 Task of the respondent (LU)

	Frequency	Percent of sample
Rector / board	1 (3)	5.3
Policy advisor	5 (10)	26.3
Head of department	3 (10)	15.8
Support unit (Educational)	2 (14)	10.5
Support unit (Technological)	2 (14)	10.5
Support person faculty	1 (…)	5.3
Instructor	4 (2690)	21.1
Student	1 (34000)	5.3
Total	19	100.0

As has been done in the other three case studies the tasks of the respondents have been combined into new categories in order to make further calculations more useful. The rector / board, policy advisors and head of faculties or departments have been combined in the role of "policy". Respondents from the educational and the technological support units and the support persons in a faculty or department have been combined in the role of "support". The instructors and the students have been combined in the role "education". This is presented in Table 66.

Table 66 Roles of the respondents (LU)

	Frequency	Percent of sample
Policy	9	47.4
Support	5	26.3
Education	5	26.3
Total	19	100.0

The respondents were asked to answer the interview questions to their best knowledge. If the questions related to situations in which some of the respondent had no personal experience the respondents were asked to give their perception of the situation at Lund University. For instance a question about using a particular ICT application in education cannot be answered for a specific teaching context by respondents in the category "policy". Therefore they gave their views on this in reference to the whole university context.

Regarding the new forms of ICT that are used at Lund University the following observations are made. There is only one respondent (from the category support) that indicates that LUVIT, the electronic learning environment, is the only means of supporting education with ICT. Most of the respondents (58%) use a combination of applications, including LUVIT. However, the majority of the respondents that indicated that LUVIT is used in combination with other application are not categorised in the education category. Five of the respondents have a policy role and three a support role. There are only three instructors of a total of five that use LUVIT in combination with other ICT applications. This can be seen in Table 67.

Table 67 New form of ICT per role of the respondent (LU)

New form of ICT	Roles of the respondents			Group Total
	Percent of Policy (n=9)	Percent of Support (n=5)	Percent of Education (n=5)	
Only the electronic learning environment LUVIT	0	5.3	0	5.3
Only Websites	5.3	0	10.5	15.8
Only computer based training	0	0	0	0
Only videoconferencing	0	0	0	0
Combination of applications	15.8	5.3	0	21.1
Combination of applications incl. LUVIT	26.3	15.8	15.8	57.9
Group Total	47.4	26.3	26.3	100

Other new forms of ICT that are used at Lund University are Websites (as indicated by two instructors and one support person), and a combination of applications, which include computer-based training and Websites.

With regard to the implementation scale Table 68 shows that most of the respondents state that there are coordinated and supported activities at the university to implement new forms of ICT in education. There is also an indication that there is some integration of new forms of ICT in teaching and learning.

Table 68 Implementation scale (LU)

	Roles of the respondents			
	Policy (n=9)	Support (n=5)	Education (n=5)	Group Total
1. Incidental, one or more instructors	1	0	0	1
2. Increasing awareness, at all levels	2	0	1	3
3. Coordinated and supported activities	6	4	3	13
4. Integrated in teaching and learning	0	1	1	2

This section presented general information about the respondents, the way ICT is used in an educational context and the scale on which ICT is implemented. In the next section more information is given about the factors that influence the use of new forms of ICT at Lund University.

7.6.4 Results: Factors that influence the use of new forms of ICT

In this section the research question "Which factors effect change processes in universities with regard to using new forms of ICT in education?" is addressed for Lund University. From the interviews and the ICT Factors score table (see Appendix E) the following list of ICT factors indicated as influencing the use of new forms of ICT in education at Lund University is presented in descending order in Table 69.

Table 69 ICT factors (LU) (n=19)

ICT Factor	Number of times the factor is indicated as important	ICT Factor	Number of times the factor is indicated as important
New conceptions of learning	17	New market	8
Improved access to education	16	Changing student demographics	8
Educational and technical support	16	Broad participation	8
Active learning	15	Leadership	8
Part-time students	14	Cost-effectiveness	8
New teaching models	14	Administrative support	8
Availability technology	14	On-demand training	7
Availability facilities	13	Response to threats & opportunities	7
Lifelong learning	12	Partnerships	6
New technology (push, hype)	12	Dynamic environment	6
Focus on learner/learning	12	Competition	6
Flexibility	11	Concrete plans	6
Funding	10	Tailor-made products	5
Demands from learners	10	Demands from employers	5
Emerging technology	10	Shared vision	5
Dependence on IT	10	Knowledge management	4
Education as business	9	Reducing costs	2
Individual differences	9	(New) organisational structure	1
Benefits	9		

Table 69 shows that the factors that have been mentioned by at least two-thirds (12 or more) of the respondents are most of all related to educational developments, support facilities and environmental pressures. Knowledge management, reducing costs and having an organisational structure that allows for full-scale implementation of new forms of ICT in education are factors that are mentioned least.

In the next section the results in relation to organisational change and the five organisational change questions are given.

7.6.5 Results: Organisational change

In addition to the ICT factors the five OC questions as presented in Chapter 4, Section 4.2 were used to address the research question. The respondents were asked to answer these questions in relation to the specific context of Lund University. Table 70 shows the overview of the answers of the respondents to the five questions. After the table a description of the answers per question is given.

Table 70 Organisational change (LU)

			Roles of the respondents		
OC question and answer dimension	Frequency (total, n=19)	Percent of sample	Percent of sample Policy (n=9)	Percent of sample Support (n=5)	Percent of sample Education (n=5)
Cause: Social	12	63	89	40	40
Cause: Economic	7	37	11	60	60
Constituents: Multiplicity	4	21	11	40	20
Constituents: Institutional	15	68	89	60	80
Content: Consistency	10	53	33	80	60
Content: Constraints	9	47	67	20	40
Control: Coercion	0	0	0	0	0
Control: Voluntary	19	100	100	100	100
Context: Uncertainty	4	21	11	20	40
Context: Interconnectedness	15	79	89	80	60

The cause of change

The first question about the cause of the change was coded on the dimensions of legitimacy or social fitness and efficiency or economic fitness. Almost two-thirds of the respondents indicated that at Lund University there is a social motive to support new forms of ICT in education. These motives relate primarily to the quality of education and giving students the flexibility to learn at their own time. The 37% of the respondents that have economic reasons refer to possibility to attract new students if education is supported by new forms of ICT.

The constituents of change

For the question about the constituents of the change answer categories were “multiplicity of constituent demands” and “dependence on institutional constituents”. During the interviews this was interpreted as internal versus external involvement in the decision to use new forms of ICT in education. Two-third’s of the respondents indicate that supporting some new form of ICT in education has been done because of the enthusiasm of staff

members of the university itself. These enthusiastic staff members stimulate others to start using new forms of ICT in education. Some respondents indicated that there has been external involvement. In these instances European projects and projects with companies have been mentioned.

The content of change
For the question about the content of the change the answer categories were "consistency with organisational goals" and "discretionary constraints imposed on the organisation". These answer categories were interpreted as whether using new forms of ICT has brought a change in the way education is delivered or not. The answers of the respondents are approximately equally divided, but looking at the distribution of the answers from the different groups of persons, as presented in Table 70, it can be seen that it is the group of the policy persons who have the highest expectations. They assume that what happens in the university related to new forms of ICT in education has brought a change in the way education is delivered.

The control of change
The fourth OC question is concerned with the control of the change. For the control of the change the answer categories were "coercion or enforcement" and "voluntary diffusion of norms". There was complete consensus in the answers of the respondents on this question: no coercion has been perceived by the respondents to implement new forms of ICT in education.

The context of change
The answer categories for the final question about the context of the change were "environmental uncertainty" and "environmental interconnectedness". The answers by the respondents on this question resulted in almost 80% of the respondents that indicated that the environment of the university, faculty or department is stable. The respondents indicating that the environment is unstable referred to diminishing student numbers.

7.6.6 Results: Profiles

In Chapter 5 (describing the literature study) four profiles of universities in change processes involving ICT were outlined. In this section this is repeated for Lund University and presented in Table 71.

Table 71 Profiles (LU)

	Frequency	Percent of sample	Roles of the respondents: Policy (n=9)	Support (n=5)	Education (n=5)
1. Supporting learners in a changing world	1	5.3	1	0	0
2. Developing expertise in the university	11	57.9	7	2	2
3. Surviving in a competitive world	3	15.8	0	1	2
4. Evolving to a cost-effective approach in education	4	21.1	1	2	1
Total	19	100.0	9	5	5

From Table 71 it can be seen that Profile 2, developing expertise in the university, is the profile in which almost 60% of the respondents can be fitted, but from the roles of the respondents it can be seen that the respondents in this profile are primarily policy persons. Profile 4, evolving to a cost-effective approach in education is the other profile in which all groups of respondents are represented. As had been done for the other universities a table is made which presents which factors per profile were mentioned as important by at least 50 percent of the respondents categorised in the profiles. This is presented in Table 72.

Table 72 ICT Factors per profile (LU)

(✔ if 50% or more of the respondents choosing the profile also chose the factor)

Factors	Profile 1 Supporting learners in a changing world (n=1)	Profile 2 developing expertise in the university (n=11)	Profile 3 Surviving in a competitive world (n=3)	Profile 4 Evolving to a cost-effective approach (n=4)
Part-time students	✔	✔	✔	✔
Improved access to education	✔	✔	✔	✔
New conceptions of learning	✔	✔	✔	✔
New teaching models	✔	✔	✔	✔
Focus on learner/learning	✔	✔	✔	✔
Active learning	✔	✔	✔	✔
Educational and technical support	✔	✔	✔	✔
Availability facilities	✔	✔	✔	
Lifelong learning	✔	✔		✔
Benefits	✔	✔		✔
New market	✔		✔	✔
Flexibility	✔		✔	✔
Broad participation	✔		✔	✔
New technology (push, hype)		✔	✔	✔
Availability technology		✔	✔	✔
Dependence on IT	✔	✔		
Leadership	✔	✔		
Administrative support	✔	✔		
Education as business	✔		✔	
On-demand training	✔		✔	
Competition	✔			✔
Response to threats and opportunities	✔			✔
Demands from learners	✔			✔
Individual differences	✔			✔
Emerging technology		✔	✔	
Funding		✔		✔
Cost-effectiveness		✔		✔

Table 72 continues...

Table 72 (continued)

Partnerships	✓			
Tailor-made products	✓			
Dynamic environment	✓			
Demands from employers	✓			
Concrete plans	✓			
Knowledge management				✓
Changing student demographics				✓

From Table 72 it can be seen that there are seven factors that are common for all four profiles. These are part-time students, improved access to education, new conceptions of learning, new teaching models, focus on learner/learning, active learning and the availability of educational and technical support (indicated in the upper grey cells). Only for Profiles 1 and 4 factors can be identified as differentially for these profiles, because they are mentioned only in Profile 1 and 4. These are for Profile 1 partnerships, tailor-made products, dynamic environment, demands from employers and concrete plans. For Profile 4 the distinguishing factors are knowledge management and changing student demographics.

7.6.7 Relation of the four profiles and the implementation of new forms of ICT

The relation between the four profiles with which the respondents of the university are associated are combined with the form of ICT that has been chosen and the level of implementation. The results of this analysis is presented in Table 73.

Table 73 Combining the four profiles and the implementation of new forms of ICT (LU)

New form of ICT	Level of implementation	Percentage of implementation scale in Profile 1 (n=1)	Percentage of implementation scale in Profile 2 (n=11)	Percentage of implementation scale in Profile 3 (n=3)	Percentage of implementation scale in Profile 4 (n=4)
Only the electronic learning environment LUVIT	coordinated and supported activities	0	0	100	0
Only Websites	incidental, one or more teachers	0	100	0	0
	increasing awareness, at all levels	0	0	0	100
	coordinated and supported activities	0	0	100	0
Combination of applications	increasing awareness, at all levels	0	100	0	0
	coordinated and supported activities	0	50	0	50

Table 73 continues…

Table 73 (continued)

Combination of applications including LUVIT	coordinated and supported activities	11	56	11	22
	integrated in teaching and learning	0	100	0	0

Examining the choice to use the electronic learning environment LUVIT in education, from Table 77 it can be seen that the use of LUVIT as the only means to support education is associated with Profile 3. If LUVIT is combined with other applications and implemented with coordinated and supported activities the Profiles 2 and 4 are important. Profile 2 is associated with an integrated use of LUVIT in combination with other ICT applications. From this it can be concluded that if the LU wants to bring the level of implementation of LUVIT in its teaching and learning process it is important to consider the social motives for using a new form of ICT in education in a stable environment.

7.6.8 Synthesis

Summarising the results of the previous sections the following observations can be made:

- At Lund University a combination of ICT applications, including LUVIT is used. However, the majority of the respondents that indicated that LUVIT is used in combination with other ICT applications are not categorised in the education, but in the policy category. With regard to the implementation scale most of the respondents indicate that there are coordinated and supported activities at the university to implement new forms of ICT in education and there are some signs that there is some integration of new forms of ICT in teaching and learning.
- The factors that have an influence on the decision to use a new form of ICT in education at Lund University are most of all related to educational developments, support facilities and environmental pressures. The most important factors are new conceptions of learning, improved access to education, educational and technical support, active learning, part-time students, new teaching models, availability technology and facilities, lifelong learning, the push for using new technology and the focus on learner/learning.
- The results related to organisational change and the five OC questions related to cause, constituents, content, control and context resulted in the following tendencies: there is primarily a social motive to use new forms of ICT in education, but economic reasons are also important. The majority of the persons that have been involved in supporting new forms of ICT in education are from the university itself. Using new forms of ICT has not brought a major change in the way education is offered and supported by half of the respondents, but these respondents are primarily policy persons. New forms of ICT have been implemented in education on a voluntary basis. The context of the university is generally speaking perceived as stable or interconnected.
- With regard to the profiles for Lund University it was suggested that Profile 2, developing expertise in the university, is the profile in which almost 60% of the respondents can be fitted, but from the roles of the respondents it can be seen that the respondents in this profile are primarily policy persons. Profile 4, evolving to a cost-effective approach in education is the profile in which all groups of respondents are represented more equally.

- The factors that are important in all four profiles are part-time students, improved access to education, new conceptions of learning, new teaching models, focus on learner/learning, active learning and the availability of educational and technical support. The factors partnerships, tailor-made products, dynamic environment, demands from employers and concrete plans are specifically important for Profile 1. There are no real distinguishing factors for Profile 2 and Profile 3. For Profile 4 knowledge management and changing student demographics are the differentiating factors.

Comparing the profiles of Lund University with those as described in Chapter 5 (Section 5.4) there are differences and similarities between the factors that were found for each profile in the literature study compared to the factors per profile in the case study at Lund. In the literature study there were no real distinguishing factors found for Profile 1. For Lund several factors from environmental pressures and the factor concrete plans were found as differentiating factors. In the literature study shared vision and active learning were factors that are of importance for Profile 2, but no factors were found in the case study at Lund that are only mentioned in Profile 2. This is the same for Profile 3; in the literature changing student demographics, lifelong learning and demands from learners were important, but no factors were found in the case study at Lund that are only mentioned in this profile. The differentiating factor in Profile 4 changed from leadership in the literature study to knowledge management and changing student demographics in Lund.

These results are presented in Table 74 where the checks show which variables were indicated as important in the profiles of the literature study and those variables that were indicated as important in the profiles of Lund.

Table 74 Differences in differentiating factors per profile (literature - LU)

	Profile 1 (lit.)	Profile 1 (LU)	Profile 2 (lit.)	Profile 2 (LU)	Profile 3 (lit.)	Profile 3 (LU)	Profile 4 (lit.)	Profile 4 (LU)
Partnerships		✓						
Tailor-made products		✓						
Dynamic environment		✓						
Demands from employers		✓						
Concrete plans		✓						
Shared vision			✓					
Active learning			✓					
Changing student demographics					✓			✓
Lifelong learning					✓			
Demands from learners					✓			
On-demand training								
Individual differences								
Leadership							✓	
Knowledge management								✓

In the next section a summary is given of the within-site analysis. The universities and the groups of respondents (policy, support and education) will be compared.

7.7 Comparison of results of the within-site analyses

This section gives an overview of comparisons between the universities and between the groups of respondents (policy, support and education) in relation to the new forms of ICT that are used at the specific universities (Section 7.7.1), the level of implementation that has been reached at those universities (Section 7.7.2), the ICT factors that have been indicated as having an important influence on the decision to use a (new) form of ICT in education (Section 7.7.3), the answers on the questions related to organisational change (Section 7.7.4) and the four profiles that have been constructed in Chapter 5 and tested in this chapter (Section 7.7.5).

7.7.1 New forms of ICT

In each of sections that described the results of the case studies at the University of Twente, the K.U. Leuven, the Helsinki University of Technology and Lund University a table was presented with the new forms of ICT that were indicated by the different respondents as being implemented. Table 75 presents the combined results of the four universities.

Table 75 Summary of form of ICT for UT, KUL, HUT and LU

	Percent of sample UT (n=34)	Percent of sample KUL (n=17)	Percent of sample HUT (n=18)	Percent of sample LU (n=19)
Only an electronic learning environment	14.7	0	0	5.3
Only Websites	2.9	11.8	0	15.8
Only computer based training	0	0	5.6	0
Only videoconferencing	0	5.9	0	0
Combination of applications	2.9	70.6	94.4	21.1
Combination of applications including an electronic learning environment	79.4	11.8	0	57.9
Total	100	100	100	100

Several observations can be made based on Table 75. First of all it can be observed that all universities make heavy use of combinations of ICT applications, often including the use of an electronic learning environment. This seems to be particularly true for the UT and the LU with their electronic learning environments TeleTOP and LUVIT. From the results of the UT described in Section 0 it can indeed be verified that an electronic learning environment is used throughout the university: TeleTOP. This is indicated by the respondents and there is evidence in the form of policy and strategy documents that state that the UT wants to be an ICT university with a campus-wide electronic learning environment as support for all students. For Lund University this is less clear. The strategy and policy documents do not place the same importance on being an ICT-minded university with a campus-wide electronic learning environment as the UT does. Nevertheless, the respondents have stated that the electronic learning environment LUVIT is used throughout the university. In relation to this it has to be noted that the majority of the respondents that indicated this are from the policy and support group of persons, not from the category of education.

Other observations that can be made based on Table 75 relate to the use of individual Websites for learning-related purposes. There are not many respondents that indicated that

they make use of Websites alone. The use of Websites is often combined with the use of other applications, such as computer-based training or domain specific computer programmes. Likewise this explains the small number of respondents that indicate that they use computer-based training as the only ICT means to support their education.

Videoconferencing seems to be a different story. This form of ICT was included in this study, but most respondents distinguish videoconferencing from other applications because of several extra demands that have to be met when using this ICT application. First of all the technical hard- and software is not available for everyone and is quite often very expensive. Furthermore, videoconferencing is not perceived as particularly useful for education for regular students and this group of students still is the major market for the universities. In addition to these reasons it is still unknown to many how videoconferencing can be used effectively in a traditional educational setting. From the interviews with the respondents it can be concluded that videoconferencing is only used in very specific settings such as the Pentalfa project at the K.U. Leuven (see Section 7.4.3).

7.7.2 The implementation scale

The next topic that is discussed in this comparison of universities is the perception of the respondents related to the level of implementation that has been reached at the four universities. The comparison of universities is presented in Table 76.

Table 76 Summary of level of implementation scale for UT, KUL, HUT and LU

	Percent of sample UT (n=34)	Percent of sample KUL (n=17)	Percent of sample HUT (n=18)	Percent of sample LU (n=19)
1. Incidental, one or more instructors	0.0	11.8	5.6	5.3
2. Increasing awareness, at all levels	0.0	58.8	27.8	15.8
3. Coordinated and supported activities	58.8	29.4	66.7	68.4
4. Integrated in teaching and learning	41.2	0.0	0.0	10.5
Total	100	100	100	100

From Table 76 it can be seen that the implementation scale at three of the four universities (the UT, HUT and LU) tends to be at the level of coordinated and supported activities. At each university that was visited for this study there was a high level of support available for those persons that want to use ICT applications for learning-related purposes. This support includes not only central support units related to technological and pedagogical support, but in many cases a specific support person was appointed at the different faculties and departments. From the interviews and the results of the analyses the availability of support and support facilities appears to be one of the most necessary factors for reaching a higher level of implementation at the universities.

Another observation that can be made from Table 76 is that the respondents of the University of Twente perceive the implementation scale of ICT at a high level: over 40% of the respondents indicate that ICT has been integrated in teaching and learning. To a certain extent this is also true for Lund University, although only 10% of the respondents perceive ICT as integrated in the teaching and learning process.

7.7.3 Factors that influence the use of new forms of ICT

For each university the perception of the respondents related to the ICT factors that had an influence on the decision to use an (new) form of ICT in education was presented. Table 77 presents the comparison of the universities related to the ICT factors.

Table 77 Summary of ICT factors for UT, KUL, HUT and LU (n=88)

ICT factor	Percent of UT sample (n=34)	Percent of KUL sample (n=17)	Percent of HUT sample (n=18)	Percent of LU sample (n=19)
New market	32.4	29.4	22.2	42.1
Education as business	8.8	41.2	11.1	47.4
Part-time students	55.9	35.3	66.7	73.7
Lifelong learning	38.2	58.8	55.6	63.2
On-demand training	20.6	41.2	16.7	36.8
Funding	23.5	11.8	44.4	52.6
Partnerships	29.4	47.1	44.4	31.6
Tailor-made products	26.5	17.6	11.1	26.3
Dynamic environment	35.3	29.4	61.1	31.6
Competition	41.2	23.5	44.4	31.6
Response to threats and opportunities	32.4	41.2	33.3	36.8
Flexibility	73.5	64.7	66.7	57.9
Knowledge management	17.6	17.6	22.2	21.1
Changing student demographics	23.5	52.9	33.3	42.1
Demands from employers	17.6	35.3	38.9	26.3
Demands from learners	32.4	35.3	66.7	52.6
Emerging technology	58.8	47.1	50.0	52.6
Dependence on IT	20.6	23.5	55.6	52.6
New technology (push, hype)	61.8	35.3	38.9	63.2
(new) organisational structure	26.5	17.6	33.3	5.3
Broad participation	32.4	52.9	55.6	42.1
Shared vision	35.3	70.6	38.9	26.3
Concrete plans	23.5	52.9	16.7	31.6
Improved access to education	52.9	52.9	50.0	84.2
Leadership	35.3	29.4	22.2	42.1
New conceptions of learning	58.8	88.2	77.8	89.5
New teaching models	52.9	52.9	77.8	73.7
Focus on learner/learning	41.2	47.1	66.7	63.2
Individual differences	41.2	35.3	33.3	47.4
Active learning	67.6	70.6	72.2	78.9
Reducing costs	5.9	0.0	16.7	10.5
Cost-effectiveness	26.5	29.4	55.6	42.1
Benefits	44.1	64.7	50.0	47.4
Administrative support	70.6	29.4	33.3	42.1
Educational and technical support	73.5	58.8	50.0	84.2
Availability technology	82.4	64.7	61.1	73.7
Availability facilities	88.2	47.1	61.1	68.4

From Table 77 it can be seen that:

- For the UT the availability facilities and technology, technical and administrative support, offering flexibility and active learning are the ICT factors that are mentioned by at least two-thirds of the respondents. Education as business and reducing costs are mentioned by less than 15% of the respondents.
- For the K.U. Leuven new conceptions of learning, active learning and shared vision are the most important factors (mentioned by at least two-thirds of the respondents). Reducing costs is not mentioned at all.
- Factors that are important for at least two-thirds of the respondents at the HUT are new teaching models, new conceptions of learning and active learning. Tailor-made products and education as business are mentioned by less than 15% of the respondents.
- At the LU new conceptions of learning, educational and technical support, improved access to education, active learning, availability technology, part-time students, new teaching models and the availability of facilities are factors that are important for at least two-thirds of the respondents. Reducing costs and a new organisational structure that allows for full-scale implementation of ICT in education are factors that are mentioned by less than 15% of the respondents.

With these results it can be seen that there is a different emphasis on support facilities and educational developments. Relating this to what has been said in the previous paragraph about the level of implementation of new forms of ICT in education it can be seen that the university with the highest level of implementation and integration (the UT) the availability of support facilities are more important, while the respondents of the K.U. Leuven and the HUT perceive educational developments as more important. The respondents of LU, according to the results presented in Table 76 in a transition from implementation to integration, indicated a combination of the availability of support facilities and educational developments as important. This relation between the level of implementation and the importance of the ICT factors has probably a relation to the life cycle of a technology innovation in education as described in Chapter 1, Section 1.2: in the stages of initiation and implementation more emphasis is on first-time experiences and trying out the possibilities of new forms of ICT in education, while at the stage of institutionalisation (or integration of ICT in the teaching and learning process) ICT has become an integral part of the ordinary operating procedures, requiring the necessary resources and facilities.

7.7.4 Organisational change

The topic of organisational change has been discussed by examining the five OC questions related to the cause, the constituents, the content, the control and the context of the change. Comparing the answers of the respondents at the different universities results in Table 78.

Table 78 Summary of organisational change questions for UT, KUL, HUT and LU

		Percent of sample UT (n=34)	Percent of sample KUL (n=17)	Percent of sample HUT (n=18)	Percent of sample LU (n=19)
Cause	Social	62	82	78	63
	Economic	38	18	22	37
Constituents	Multiplicity	6	35	11	21
	Institutional	94	65	89	68
Content	Consistency	38	29	78	53
	Constraints	62	71	22	47
Control	Coercion	65	0	6	0
	Voluntary	35	100	94	100
Context	Uncertainty	68	41	56	21
	Interconnectedness	32	59	44	79

From Table 78 it can be seen that all respondents at all four universities have primarily social reasons to use a (new) form of ICT in education. These social reasons include for instance the idea that with the support of ICT applications the quality of education can be enhanced and that the support of the learning process of the students can be improved. The economic reasons that were mentioned in the results of the study at the four universities were primarily related to using new forms of ICT to attract more students.

There is also not much difference between the universities in relation to the constituents of the change, interpreted as internal versus external involvement in the decision to use new forms of ICT in education. The majority of the respondents at all four universities indicated that internal involvement has been the major push to use new forms of ICT. With regard to the question about the content of the change there are some differences at the four universities. The majority of the respondents at the UT and the KUL indicated that there has been a change in the way education is supported and delivered since the implementation of new forms of ICT. The respondents at the HUT indicate the opposite and the respondents at the LU are divided in two almost equal groups.

The UT is the only university in this study for which it can be stated that coercion or enforcement to use new forms of ICT in education has been perceived by the majority of the respondents. At the other universities the number of respondents that indicated coercion is minimal. If this is related to what has been said in the previous paragraphs about the level of implementation and the importance of specific ICT factors it could be deducted that the UT, the university with a high level of implementation and integration of new forms of ICT in education, has reached this high level of implementation because of the enforcements that have been exercised in relation to the use of TeleTOP as an electronic learning environment.

With regard to the question about the context of the change there are also differences between the universities. The respondents of the UT perceive the context of the university as uncertain. This is related to diminishing student numbers and funding and to reorganisation of parts of the university. Half of the respondents from the KUL and the HUT perceive their environment as reasonably stable, the other half sees some

uncertainties, again related to diminishing numbers of students and funding. The majority of the respondents at LU perceive their environment as stable or certain. Again, this could give an indication of why the UT has a high implementation level of new forms of ICT: it could be that this is related to the (unstable) environment of the university.

7.7.5 The four profiles

Each of the sections about the profiles of the four universities indicated how the universities are associated with the profiles. This is summarised in Table 79.

Table 79 Summary of Profiles for UT, KUL, HUT and LU

	Percent of sample UT (n=34)	Percent of sample KUL (n=17)	Percent of sample HUT (n=18)	Percent of sample LU (n=19)
Profile 1: Supporting learners in a changing world	41.2	29.4	44.4	5.3
Profile 2: Developing expertise in the university	20.6	52.9	33.3	57.9
Profile 3: Surviving in a competitive world	26.5	11.8	11.1	15.8
Profile 4: Evolving to a cost-effective approach in education	11.8	5.9	11.1	21.1
Total	100	100	100	100

The UT and the HUT have the majority of the respondents in Profile 1, the combination of social reasons for using a new form of ICT in education and the fact that the environment around the university is uncertain. The KUL and the LU are in general associated with Profile 2, a combination of social reasons for using new forms of ICT in education and the fact that the environment around the university is certain. Thus, all four universities seem to have primarily social reasons for using new forms of ICT in education and as has been observed in the previous section the perceived context of the university can be both uncertain and certain/stable. The relation of the four profiles, the new forms of ICT and the level of implementation of this form of ICT is presented in the next section.

7.7.6 The four profiles and the implementation of new forms of ICT

Combining the Table 38 (the combination of the four profiles and the implementation of new forms of ICT at the UT), Table 49 (the combination at the KUL), Table 61 (the combination at the HUT) and Table 73 (the combination at LU) the results of the combination of the four profiles and the implementation of new forms of ICT for the overall EUNITE can be presented as is done in Table 80.

Table 80 Combining the four profiles and the implementation of new forms of ICT (UT, KUL, HUT and LU)

New form of ICT	Level of implementation	Percentage of implementation scale in Profile 1 (n=28)	Percentage of implementation scale in Profile 2 (n=33)	Percentage of implementation scale in Profile 3 (n=16)	Percentage of implementation scale in Profile 4 (n=11)
Only an electronic learning environment	coordinated and supported activities	0	50	50	0
	integrated in teaching and learning	25	0	50	25
Only Websites	incidental, one or more teachers	50	50	0	0
	increasing awareness, at all levels	0	0	50	50
	coordinated and supported activities	0	0	50	50
Only computer-based training	increasing awareness, at all levels	100	0	0	0
Only videoconferencing	incidental, one or more teachers	0	0	0	100
Combination of applications	incidental, one or more teachers	0	100	0	0
	increasing awareness, at all levels	40	53	7	0
	coordinated and supported activities	33	39	11	17
Combination of applications including an electronic learning environment	coordinated and supported activities	29	43	14	14
	integrated in teaching and learning	42	25	33	0

The most interesting results presented in Table 80 relate to the use of an electronic learning environment (as stand alone application or in combination with other ICT applications). As can be seen from Table 80 if an electronic learning environment is used as the only means of supporting educational processes, coordinated and supported activities are associated with Profiles 2 and 3 and integrating the environment in teaching and learning primarily with Profile 3. An electronic learning environment in combination with other ICT applications seems to be associated with Profile 2 if there are primarily coordinated and

supported activities for the implementation. Integrating the environment in the teaching and learning process in combination with other applications seems to be primarily associated with Profile 1 (and 3).

From these results it seems that the characteristics of Profile 3 (an economic motive to use new forms of ICT in education and the fact that the environment around the university or department is uncertain) are the ones to be accounted for when discussing a higher level of implementation. But considering what has been said in the previous section about the profiles (and especially the fact that the Profiles 1 and 2 seem to be the best suited profiles for the four universities) a general conclusion about the relation of the profiles with the implementation of an electronic learning environment cannot be drawn. A possible explanation for this result is that the implementation of an electronic learning environment at a high level is university-specific. On the other hand, these results relating to Profile 3 indicate that the economic motives that play a role in Profile 3 (and not in Profiles 1 and 2) are important issues to consider when a university wants to move from pilot projects and increasing awareness to a more integrated approach of new forms of ICT in education.

With this idea this section with the summary of the results of the within-site analysis of the four case studies is concluded. In the next chapter all data of the four case studies will be combined into one data set to make a more in-depth analysis of the ICT factors, the organisational change questions and the profiles.

8 Case studies within the EUNITE network, cross-site analysis

This chapter describes the results of the cross-site analysis of the case studies in the EUNITE network. The data of the four individual case studies are combined in one set of data. This data set is used for the cross-site analysis that is described in this chapter. An overview and the goals of this case study and the method of analysis are given in Section 8.1. The results related to general information about respondents and the use of new forms of ICT, factors that influence the use of new forms of ICT, the five questions about organisational change and the profiles are described in the Sections 8.2. Sections 8.3-8.7 describe nine possible alternative approaches of universities with regard to using new forms of ICT in education. This chapter concludes with a synthesis of the results and their relationship to the implementation of new forms of ICT in education in Section 8.8.

8.1 Overview, goals and method of analysis of the study

The previous chapter described the results of the within-site analysis of the four individual case studies within the EUNITE network. At the end of Chapter 7 a comparison was made between the four universities. This chapter combines the data of all respondents in the four case studies into one overall EUNITE case study. As has been described in Chapter 7 the EUNITE network consists of more than four partner universities, but in this research the combination of the four universities will be referred to as the EUNITE case study. The objective of the cross-site case study is to find an answer to the overall research question and the sub Research Questions 3 to 8.

The same variables were used in the cross-site EUNITE case study as in the individual case studies described in Chapter 7 (see Table 25) with the addition of the variables presented in Table 81.

Table 81 Overview of the variables used in the EUNITE case study

Variable	Values
University	UT (University of Twente)
	KUL (Catholic University at Leuven
	HUT (Helsinki University of Technology)
	LU (University of Lund)
Old or new university	UT - HUT (combination of UT and HUT: new)
	KUL - LU (combination of KUL and LU: old)
Universities in countries	NL - BE (combination of Dutch-Flemish universities)
	FI - SW (combination of Nordic universities)

The results related to general information about respondents and the use of new forms of ICT, factors that influence the use of new forms of ICT, the five questions about organisational change and the profiles is described in the next section.

8.2 EUNITE, general information, ICT factors, organisational change and profiles

This section presents the general information that came out of the EUNITE case study when combinin
g the four separate sets of data of the four universities into one data set. This general information relates to the distribution of the respondents in the roles that have been defined (policy, support and education), the new forms of ICT applications that are used, the implementation levels of ICT, the ICT factors that have an influence on the decision to use and support an (new) form of ICT in education, the five questions related to organisational change and to the four profiles. An overview of these topics is given in Sections 8.2.1-8.2.4.

8.2.1 General information

By combining the four separate sets of data of the four universities into one data set the number of respondents in the EUNITE case study is 88. The distribution of the 88 respondents over the three groups (or roles) of respondents is presented in Table 82.

Table 82 Roles of the respondents EUNITE

	Frequency	Percent of sample
Policy	32	36.4
Support	32	36.4
Education	24	27.3
Total	88	100.0

For the whole data set the new forms of ICT that are supported in the EUNITE case study is calculated and presented in Table 83, including the perceptions of the groups of respondents on the new forms of ICT that are used in the universities.

Table 83 Summary of form of ICT for EUNITE

			By roles of the respondents		
	Frequency	Percent of total sample	Percent of sample Policy (n=32)	Percent of sample Support (n=32)	Percent of sample Education (n=24)
Only an electronic learning environment	6	6.8	0.0	12.5	8.3
Only Websites	6	6.8	6.3	3.1	12.5
Only computer based training	1	1.1	0.0	0.0	4.2
Only videoconferencing	1	1.1	3.1	0.0	0.0
Combination of applications	34	38.6	37.5	43.8	33.3
Combination of applications including an electronic learning environment	40	45.5	53.1	40.6	41.7
Total	88	100	100	100	100

From Table 83 several comments can be made. First of all, combinations of applications (also including an electronic learning environment) is the form of ICT that is most supported. In relation to the roles of the respondents it can be seen that only support and education persons indicate that at the universities some teaching and learning activities are supported by an electronic learning environment alone. However, a combination of ICT

applications, including electronic learning environments, is mentioned by all groups of respondents. For Websites, computer-based training and videoconferencing the same observations as have been made in Chapter 7, Section 7.7 can be made. These observations related to the fact that the use of Websites is often combined with the use of other applications and the several extra demands (related to technical and educational requirements) that have to be met when using videoconferencing and therefore limits its use in practice.
Table 84 presents the perceived level of implementation of new forms of ICT within the EUNITE case study including the perceptions of the different groups of respondents.

Table 84 Summary of implementation levels for EUNITE

			Roles of the respondents		
	Frequency	Percent of sample	Percent of sample Policy (n=34)	Percent of sample Support (n=34)	Percent of sample Education (n=24)
1. Incidental, one or more instructors	4	4.5	9.4	3.1	0.0
2. Increasing awareness, at all levels	18	20.5	12.5	25.0	25.0
3. Coordinated and supported activitie	50	56.8	65.6	56.3	45.8
4. Integrated in teaching and learning	16	18.2	12.5	15.6	29.2
Total	88	100.0	100	100	100

From Table 84 it can be seen that the majority of the respondents indicate that the implementation level at the universities is at the level of coordinated and supported activities. There is not much difference between the groups, but it can be seen that for the level of coordinated and supported activities the respondents from the policy group have the highest scores, but on the level of an integrated approach to ICT in teaching and learning the respondents from the education group have the highest scores. This could imply that even though the instructors perceive the availability of coordinated activities less significant than the policy and the support persons, they themselves feel that they use new forms of ICT in an integrated way.

8.2.2 ICT factors

From the complete data set the following list of ICT factors indicated as influencing the use of new forms of ICT in education within the EUNITE case study can be presented in descending order in Table 85.

Table 85 ICT factors for EUNITE (n=88)

ICT factor	Percentage of respondents that indicated factor as important (n=88)	ICT factor	Percentage of respondents that indicated factor as important (n=88)
New conceptions of learning	75.0	Dynamic environment	38.6
Availability technology	72.7	Cost-effectiveness	36.4
Active learning	71.6	Competition	36.4
Availability facilities	70.5	Partnerships	36.4
Educational and technical support	68.2	Changing student demographics	35.2
Flexibility	67.0	Dependence on it	35.2
New teaching models	62.5	Response to threats and opportunities	35.2
Improved access to education	59.1	Leadership	33.0
Part-time students	58.0	New market	31.8
Emerging technology	53.4	Funding	31.8
Focus on learner/learning	52.3	Concrete plans	29.5
New technology (push, hype)	52.3	Demands from employers	27.3
Lifelong learning	51.1	On-demand training	27.3
Benefits	50.0	Education as business	23.9
Administrative support	48.9	Tailor-made products	21.6
Demands from learners	44.3	(New) organisational structure	21.6
Broad participation	43.2	Knowledge management	19.3
Shared vision	40.9	Reducing costs	8.0
Individual differences	39.8		

From Table 85 it can be seen that the factors that are mentioned by at least two-thirds of the respondents (59 out of 88) are new conceptions of learning, the availability of technology, active learning, the availability of facilities, educational and technical support and flexibility. Three of these factors relate to the category availability of support facilities, one to educational developments and one to environmental pressures. Factors that are of minor importance and are mentioned by less than 25 % of all respondents are education as business, tailor-made products, (new) organisational structure and knowledge management. The factor that was mentioned least was reducing costs. Examining what factors are important for the different groups of respondents results in Table 86.

Table 86 Summary of ICT factors for roles of respondents

ICT factor	Percent of sample Policy (n=32)	Percent of sample Support (n=32)	Percent of sample Education (n=24
New market	34	41	17
Education as business	28	28	13
Part-time students	59	66	46
Lifelong learning	56	53	43
On-demand training	19	28	38
Funding	19	41	38
Partnerships	47	34	25
Tailor-made products	19	22	25
Dynamic environment	38	44	33
Competition	47	44	13
Response to threats and opportunities	44	34	25
Flexibility	53	72	79
Knowledge management	19	19	21
Changing student demographics	41	38	25
Demands from employers	38	22	17
Demands from learners	53	44	33
Emerging technology	56	50	54
Dependence on IT	53	22	29
New technology (push, hype)	59	63	29
(new) organisational structure	16	22	29
Broad participation	47	47	33
Shared vision	34	50	38
Concrete plans	28	38	21
Improved access to education	63	59	54
Leadership	47	34	13
New conceptions of learning	78	69	79
New teaching models	66	63	58
Focus on learner/learning	47	53	58
Individual differences	31	44	46
Active learning	59	81	75
Reducing costs	3	13	8
Cost-effectiveness	34	38	38
Benefits	56	47	46
Administrative support	53	50	42
Educational and technical support	66	72	67
Availability technology	75	66	79
Availability facilities	66	72	75

From Table 86 it can be seen that:

- For the group of respondents placed in the role of policy (rector / board, policy advisors and head of faculties or departments) the factors new conceptions of learning and the

availability of technology are mentioned by at least two-thirds of the respondents. Reducing costs is mentioned by less than 15% of the respondents in the policy group.
- For the group of respondents in the role of support (persons from the educational and the technological support units and the support persons in a faculty or department) the factors active learning, flexibility, availability facilities, educational and technical support and new conceptions of learning are mentioned by at least two-thirds of the respondents. Reducing costs is mentioned by less than 15% of the respondents in the support group.
- For the group of respondents in the role of education (instructors and students) the factors availability technology, new conceptions of learning, flexibility, active learning, availability facilities and educational and technical support are mentioned by at least two-thirds of the respondents. Again reducing costs is the least important factor according to this group of respondents, accompanied by leadership, competition and education as business.

From these results it can be seen that the three groups have an overlap with regard to the importance on several ICT factors. Interesting is the fact that over two-thirds of the respondents from the education group indicated that educational and technical support and the availability of support facilities are of major importance, while it was concluded in the previous section that the instructors perceive the availability of coordinated activities less evident than the policy and the support persons. From this there seems to be a discrepancy between what is available and what is needed by instructors.

8.2.3 Organisational change

During the separate case studies organisational change in relation to ICT in education was examined by using the five OC questions related to cause, constituents, content, control and context. For the whole data set (n=88) this resulted in the following distribution (see Table 87).

Table 87 Summary of organisational change questions for UT, KUL, HUT and LU

		Frequency	Percent of sample
Cause	Social	61	71.3
	Economic	27	28.7
Constituents	Multiplicity	14	18.35
	Institutional	74	79.03
Content	Consistency	42	49.5
	Constraints	46	50.5
Control	Coercion	23	17.58
	Voluntary	65	82.43
Context	Uncertainty	44	46.38
	Interconnectedness	44	53.63

From Table 87 it can be seen that in the overall EUNITE case study there is a tendency towards social motives for using and supporting a (new) form of ICT in education, the majority of persons involved are internal and the implementation of ICT has been voluntary. There are mixed feelings about the change that ICT has brought to the delivery of education and about the context of the university. To see if there is a difference in perception of the respondents Table 88 is presented.

Table 88 Summary of organisational change questions for roles of respondents

		Roles of the respondents		
		Percent of sample Policy (n=32)	Percent of sample Support (n=32)	Percent of sample Education (n=24)
Cause	Social	81.2	68.8	54.2
	Economic	18.8	31.3	45.8
Constituents	Multiplicity	9.4	18.8	20.8
	Institutional	90.6	81.2	79.2
Content	Consistency	50.0	43.8	50.0
	Constraints	50.0	56.2	50.0
Control	Coercion	21.9	28.1	29.2
	Voluntary	78.1	71.9	70.8
Context	Uncertainty	40.6	46.9	66.7
	Interconnectedness	59.4	53.1	33.3

With regard to the constituents, the content and the control of the change there is not much difference in the answers of the three groups. In general the persons involved in using a new form of ICT are internal. The respondents of all three groups are divided about the question related to the content of the change. About 50% of all three groups indicate that ICT has brought a change in educational delivery, but the other half disagrees. And even where Table 88 indicates an important difference in the way the change has been controlled, there seems to be no difference in the perception of the three groups of respondents related to the control: the majority of the respondents of all groups indicate that the implementation of a new form of ICT in education has been voluntary.

The main differences between the three groups of respondents appear to be related to the cause and the context of the change. With regard to the cause of the change the most apparent difference can be seen in the answers from the support and the education persons. Where the majority of the policy respondents indicate that social motives form the basic reason to use ICT in education, only two-thirds of the support persons and a little more than half of the education persons agree with this. With regard to the question related to the context, the policy and the support persons are about equally divided, but two-thirds of the education respondents indicate that they are uncertain about the context of their situation. These two aspects of cause and context are further examined in the next section about the four profiles.

8.2.4 Profiles

The next step is to determine which profiles are most suitable for this overall EUNITE case study. This is presented for the overall data set in Table 89.

Table 89 Summary of Profiles for EUNITE

	Frequency	Percent of sample
Profile 1: Supporting learners in a changing world	28	31.8
Profile 2: Developing expertise in the university	33	37.5
Profile 3: Surviving in a competitive world	16	18.2
Profile 4: Evolving to a cost-effective approach in education	11	12.5
Total	88	100.0

From Table 89 it can be seen that Profiles 1 and 2 seem to be the profiles in which most of the respondents of the EUNITE case study fit. Examining the profiles by the roles of the respondents results in Table 90.

Table 90 Summary of Profiles for roles of respondents

	Roles of the respondents		
	Percent of sample Policy (n=32)	Percent of sample Support (n=32)	Percent of sample Education (n=24)
1. Supporting learners in a changing world	28.1	31.3	37.5
2. Developing expertise in the university	53.1	37.5	16.7
3. Surviving in a competitive world	12.5	15.6	29.2
4. Evolving to a cost-effective approach in education	6.3	15.6	16.7
Total	100	100	100

From Table 90 it can be seen that the majority of the policy respondents are associated with Profile 2 and the support respondents are in general divided over Profiles 1 and 2. The majority of the education respondents are associated with Profile 1, but Profile 3 is also a possibility. This verifies what has been found in the previous section that in addition to social motives to use new forms of ICT in education the persons in the education group, primarily instructors, are interested in economic motives as well.

By combining the four data sets of the separate universities into one overall data set (and thereby increasing the number of respondents to 88) as has been done in the previous sections, it is possible to use more advanced statistical techniques. The use of these techniques is described in the next section.

8.3 EUNITE, analysis of new approaches to ICT in education

In this section the results of the factor analysis approach as described in Chapter 6, Section 6.1.10 are described. With the data set of the four case studies combined a factor analysis was carried out with the extraction method principal component analysis (PCA) with varimax rotation. The input of this specific principal component analysis are the 37 ICT factors. For each of the ICT factors a factor loading is calculated in the PCA analysis. This loading determines the value (or the importance) of the ICT factor. As a result of the PCA analysis 37 new components (thus as much components as original ICT factors) are calculated. Each component has its own loading, which is the sum of the loadings of the

original ICT factors. This can be put in the following formula, where a is the loading of ICT factor X:

Component 1 = $a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + a_{..}X_{.} + a_{137}X_{37}$

Component 2 = $a_{21}X_1 + a_{22}X_2 + a_{23}X_3 + a_{..}X_{.} + a_{237}X_{37}$

etc.

This is further described in Table 92 in which the loading coefficients for the components is presented. Before this is done it has to be decided how many of the 37 components are retained for further analysis. This is described in the next section.

8.3.1 Extraction of 9 components

Factor analysis is used to identify a small number of factors that explain most of the variance observed in a much larger number of manifest variables. The factor analysis resulted in the following Table 91 in which the total variance is explained:

Table 91 Total variance explained

	Initial Eigenvalues				Initial Eigenvalues		
Component	Total	% of Variance	Cumulative %	Component	Total	% of Variance	Cumulative %
1	6.155	16.64	16.64	20	.682	1.84	83.92
2	2.494	6.74	23.38	21	.643	1.74	85.66
3	2.106	5.69	29.07	22	.636	1.72	87.37
4	1.853	5.01	34.08	23	.554	1.50	88.87
5	1.790	4.84	38.92	24	.533	1.44	90.31
6	1.700	4.59	43.51	25	.461	1.25	91.56
7	1.645	4.45	47.96	26	.441	1.19	92.75
8	1.511	4.08	52.04	27	.414	1.12	93.87
9	1.404	3.79	55.83	28	.370	1.00	94.87
10	1.237	3.34	59.18	29	.327	0.89	95.76
11	1.189	3.21	62.39	30	.302	0.82	96.57
12	1.134	3.07	65.46	31	.272	0.74	97.31
13	1.074	2.90	68.36	32	.229	0.62	97.93
14	.980	2.65	71.01	33	.203	0.55	98.47
15	.924	2.50	73.50	34	.172	0.47	98.94
16	.859	2.32	75.83	35	.153	0.41	99.35
17	.819	2.21	78.04	36	.128	0.35	99.70
18	.766	2.07	80.11	37	.113	0.30	100.00
19	.727	1.97	82.07				

From Table 91 it can be seen that there are 13 components with an Eigenvalue above 1. This can also be represented in a scree plot as done in Figure 6.

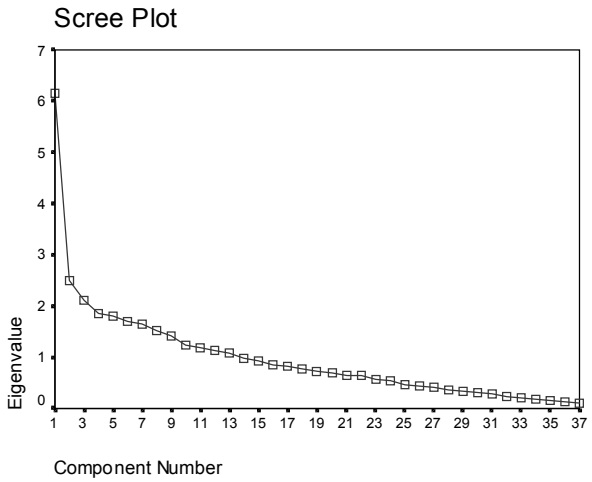

Figure 6 Scree plot

A scree plot is a plot of the Eigenvalues in descending value. It is often used to decide how many factors to retain. Typically the plot shows a distinct break between the steep slope of the large factors and the gradual trailing of the rest. In Table 91 and in Figure 6 it can be seen that there is a distinct break between Components 1 and 2. But in the scree plot it can be seen that there are also breaks between Components 3 and 4 and between Components 9 and 10. If Component 9 is included in the remainder of the analysis more that 55 percent of the total variance is explained, this seems to be an acceptable boundary. Furthermore if the nine components are included in the analysis all ICT factors but one (dynamic environment) can be included in the further analysis. This is accomplished by performing a second factor analysis, with extraction method PCA and with varimax rotation, but this time with a user-specified number of components, in this case 9. Also, the component scores were saved as new variables this time. A table with the total variance explained would be no different from the previous calculation. But with the nine components that were extracted it is possible to see which variables in the data set have high loadings in the nine major components. Table 92 reports the component loadings for each variable on the nine components after rotation. Each number represents the partial correlation between the item and the rotated factor. For the overview in Table 92 the loading coefficients with absolute values less than 0.35 are suppressed for readability and each variable is placed in one of the components by looking at the variable's highest loading among the components. In further calculations with the nine components all loadings of the variables within the components will be taken into account, Table 92 is only meant to give an overview of the most important variables per component. As can be seen in Table 92 the only variable that is not included is dynamic environment. This is probably due to the fact that a combination of other variables can be interpreted by the respondents as contributing to a dynamic environment and have left out dynamic environment itself.

Table 92 Rotated component matrix, loadings > 0.35

	Component 1	2	3	4	5	6	7	8	9
New market	.678								
Education as business	.629								
Part-time students				.701					
Lifelong learning				.520					
On-demand training							.375		
Funding									.598
Partnerships	.725								
Tailor-made products							.489		
Dynamic environment									
Competition				.649					
Response to threats and opportunities	.646								
Flexibility		.455							
Knowledge management							.613		
Changing student demographics				.539					
Demands from employers						.700			
Demands from learners						.557			
Emerging technology			.419						
Dependence on IT						.672			
New technology (push, hype)			.429						
(new) organisational structure								.531	
Broad participation		.400							
Shared vision					.706				
Concrete plans					.596				
Improved access to education							.622		
Leadership	.578								
New conceptions of learning		.368							
New teaching models		.630							
focus on learner/learning		.692							
Individual differences		.583							
Active learning		.589							
Reducing costs								.580	
Cost-effectiveness								.732	
Benefits					.632				
Administrative support			.627						
Educational and technical support									.479
Availability technology			.673						
Availability facilities			.781						

The components presented in Table 92 account for 55% of the variability in the data. With the principal component analysis nine components have been calculated and each of the ICT factors were associated with one of the components based on the loadings. From Table

92 it is possible to give a short description of the components, based on the factors that they are primarily associated with. This is done in Sections 8.3.2-8.3.10.

8.3.2 Component 1: the new marketplace

Factors that are clustered in this component: New market, Education as business, Partnerships, Response to threats and opportunities, Leadership

If a university is associated with this component, the main reasons for a university to use new forms of ICT are reaching a new market of students, including from business and industry and to become a leader in the market, striving for co-operation with partners.

8.3.3 Component 2: the pedagogy of flexible learning

Factors that are clustered in this component: Flexibility, Broad participation, New conceptions of learning, New teaching models, Focus on learner/learning, Individual differences, Active learning

If a university is associated with this component, the main reason for a university to use new forms of ICT is to offer flexibility in time and /or place. With the participation of many staff members from the university new forms of ICT are used to change education: there are new ways of looking at education and new teaching models arise. This leads to active learning with a focus on the student and the learning process in which individual differences are accounted for.

8.3.4 Component 3: the technology for flexible learning

Factors that are clustered in this component: Emerging technology, New technology (push, hype), Administrative support, Availability technology, Availability facilities

If a university is associated with this component, the main reason for a university to use new forms of ICT are the possibilities that new forms of technology offer. To use these possibilities there should be sufficient support from the management. The university will make sure that the technology and the facilities are available.

8.3.5 Component 4: students in a dynamic world

Factors that are clustered in this component: Part-time students, Lifelong learning, Competition, Changing student demographics

If a university is associated with this component, the main reasons for a university to use new forms of ICT are to anticipate the need for lifelong learning and to compete with other universities and educational providers who do the same. Because of the competition with other educational providers and the changes in student demographics, the university has to cope with other groups of learners such as part-time students.

8.3.6 Component 5: concrete vision

Factors that are clustered in this component: Shared vision, Concrete plans, Benefits

If a university is associated with this component, the main reason for a university to use new forms of ICT is to gain benefits. With a shared vision of the persons involved and with

concrete plans the universities hopes to gain benefits from using new forms of ICT in education.

8.3.7 Component 6: workplace demands for new forms of ICT in education

Factors that are clustered in this component: Demands from employers, Demands from learners, Dependence on IT

If a university is associated with this component, the main reasons for a university to use new forms of ICT are to cope with the fact that graduated students will have to deal with the dependence on IT in their future jobs. Both the students and the employers will demand that the university prepares their students for this.

8.3.8 Component 7: individualisation

Factors that are clustered in this component: On-demand training, Tailor-made products, Knowledge management, Improved access to education

If a university is associated with this component, the main reason for a university to use new forms of ICT is to anticipate the need from specific groups of students who request on-demand training and tailor-made products. To improve the possibilities for these students to have access to education the university has to store its available information (courses, modules, etc) in such a way that access is possible (knowledge management).

8.3.9 Component 8: cost-effectiveness

Factors that are clustered in this component: New organisational structure, Reducing costs, Cost-effectiveness

If a university is associated with this component, the main reason for a university to use new forms of ICT is to reduce the costs of education, or to improve the cost-effectiveness. To reach this the university will change its organisational structure to become more efficient and effective.

8.3.10 Component 9: funding for support

Factors that are clustered in this component: Funding and Educational and technical support

If a university is associated with this component, the main reasons for a university to use new forms of ICT is that the university will receive funding for it. To implement new forms of ICT educational and technical support is needed.

The list of means and standard deviations of each of the nine components in combination with the universities and the groups of respondents can be found in Appendix I.

8.4 Combining components and universities

The component scores that were derived during the principal component analysis were used to find information about the combination of the components as described in the previous section and the universities where the case studies were carried out. By performing an

ANOVA analysis it is possible to determine which components are important for all universities and which components have a significant influence on some of the universities.

8.4.1 Differences related to the components

The ANOVA procedure produces a one-way analysis of variance for a set of quantitative dependent variables, in this case the nine component scores, by a single (independent) variable, in this case the four universities. Analysis of variance is used to test the hypothesis that in each of these comparisons the means are equal with a $p \leq 0.05$ chance of error. This technique is an extension of the two-sample t test. The means and standard deviations per university are given in Appendix I. The results are presented in Table 93.

Table 93 ANOVA universities, nine component scores by the four universities

	F	Sig.
Component 1, the new marketplace	0.86	0.47
Component 2, the pedagogy for flexible learning	0.84	0.48
Component 3, the technology for flexible learning	6.82	**0.00**
Component 4, students in a dynamic world	1.22	0.31
Component 5, concrete vision	2.71	**0.05**
Component 6, workplace demands for new forms of ICT in education	3.43	**0.02**
Component 7, individualisation	0.50	0.68
Component 8, cost-effectiveness	2.51	0.07
Component 9, funding for support	1.24	0.30

From Table 93 it can be seen that on Component 1, the new marketplace, no significant difference was found. Component 1 is the component from which much of the variance was explained (almost 17%, compared to for example Component 2 with about 7% and Component 9 with about 4%). From the fact of no significant differences between the universities on this component and in relation to the amount of variance explained by this component, it can be deducted that Component 1 is an important combination of ICT factors (new market for universities, offering education as a business, using ICT as a response to threats and opportunities from the environment, aiming at leadership in the field of using new forms of ICT in education and engaging in partnerships) which are important factors for the UT, the HUT, the KUL and LU. These ICT factors are related with pressures from the environment, such as described in Chapter 1 and Chapter 3, Section 3.4. From Table 77 and Table 85 it can be seen that the factors are perceived as important by around 35% of the respondents.

For the Components 2, 4, 7, 8 and 9 also no significant difference was found among the universities which could indicate a comparable idea of similar importance of the components for the universities, but for these components it is harder to conclude the same feeling as for Component 1, because the variance explained by these components is much smaller (ranging from 4 to 7 percent).

For Components 3 (the technology for flexible learning), 5 (concrete vision) and 6 (demands for ICT in education) the means of the four universities are not equal, a significant difference was found ($p < 0.05$). This was further examined in three post hoc tests, conducted for Components 3, 5 and 6. The test chosen was Scheffé because the significance level of the Scheffé test is designed to allow all possible linear combinations of

group means to be tested with a control of type I error, not just pair wise comparisons. The result is that the Scheffé test is often more conservative than other tests, which means that a larger difference between means is required for significance (SPSS, 1989). From the post hoc test it appeared that in Component 3 the UT, the HUT and the KUL have significantly unequal means. For Component 5 and 6 no significant differences between the universities was found. Therefore only the results for Component 3 are presented in Table 94.

Table 94 Multiple Comparisons (with Scheffé alpha)

Dependent Variable	University (I)	University (J)	Mean Difference (I-J)	Std. Error	Sig.
Scores for Component 3, Technology for flexible learning	UT	KUL	1.10	.27	**.002**
		HUT	0.87	.27	**.017**
		LU	0.51	.26	.282
	KUL	HUT	-0.22	.31	.912
		LU	-0.58	.30	.310
	HUT	LU	-0.36	.30	.703

The clustered ICT factors for Components 3 are further examined in the next section. Also for Components 5 and 6 this is done because of these components do show differences between the universities in Table 93.

8.4.2 ICT factors per component

The ICT factors that were clustered in Components 3, 5 and 6 and the percentage of the respondents per university that perceived the ICT factors as important are presented in Table 95.

Table 95 ICT factors in components 3, 5 and 6 for the four universities

Component	ICT factors	Percent of sample UT (n=34)	Percent of sample KUL (n=17)	Percent of sample HUT (n=18)	Percent of sample LU (n=19)
3	Emerging technology	59	47	50	53
	New technology (push, hype)	62	35	39	63
	Administrative support	71	29	33	42
	Availability technology	82	65	61	74
	Availability facilities	88	47	61	68
5	Shared vision	35	71	39	26
	Concrete plans	24	53	17	32
	Benefits	44	65	50	47
6	Demands from employers	18	35	39	26
	Demands from learner	32	35	67	53
	Dependence on IT	32	35	67	53

From Table 95 a number of observations can be made.

- From the post hoc tests it appeared that in Component 3 the UT, the HUT and the KUL have significantly different mean scores. Table 95 shows that these difference can be

explained by all of the factors, but especially by the factor administrative support, on which the UT scores very high in comparison with the others (71% vs. 29, 33 and 42%).
- The post hoc test showed that for Component 5 the KUL and the LU differed the most, although not significantly. This can be seen for all three factors in Component 5. The KUL has the highest scores on all factors (see Appendix I).
- For Component 6 the post hoc test showed that the UT and the HUT differed most, although not significantly. The HUT scores are the highest scores for each factor (see Appendix I).

8.4.3 Discriminant analysis

In the previous section it was concluded that Component 1, the new marketplace (the component with the highest total variance explained), does not come forward in the ANOVA analysis and the post hoc tests that were carried out in relation to the four universities. But because of the conclusion related to the importance of Component 1 as described in 8.4.1 the following Figure 7 is presented:

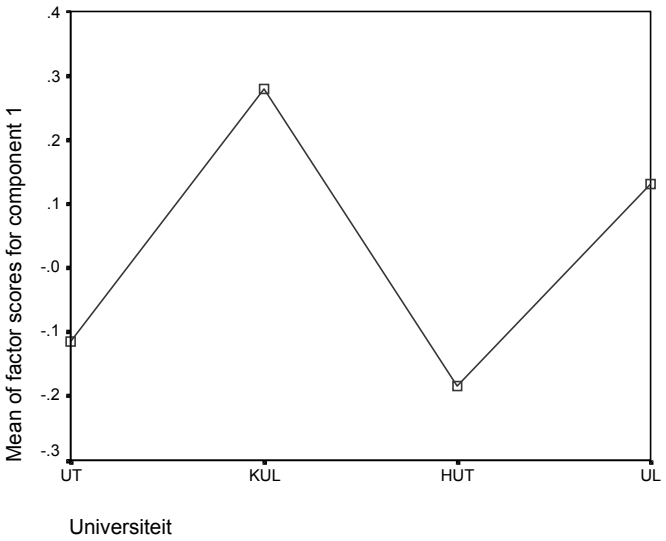

Figure 7 Means plot for the universities on Component 1

Even though the differences between the universities were not calculated as significant there is a suggestion of difference to be seen in this figure. If an imaginary line is drawn at the 0-axis it can be seen that there is a difference between (a) the UT and the HUT and (b) the KUL and the LU. With some care it is proposed here that a distinction could be made between “old”, more traditional universities (KUL and LU) and the “new”, more entrepreneurial universities (UT and HUT). Such a suggestion can be further examined with a discriminant analysis (as described in Section 6.1.10). The correlation matrix, the summary of the discriminant function analysis and the classification results are presented in Appendix J.
A plot of the boundaries (a territorial map), used to classify cases into groups based on function values, is made and presented in Figure 8. The numbers correspond to groups into which cases are classified (1 = UT, 2 = KUL, 3 = HUT, 4 = LU).

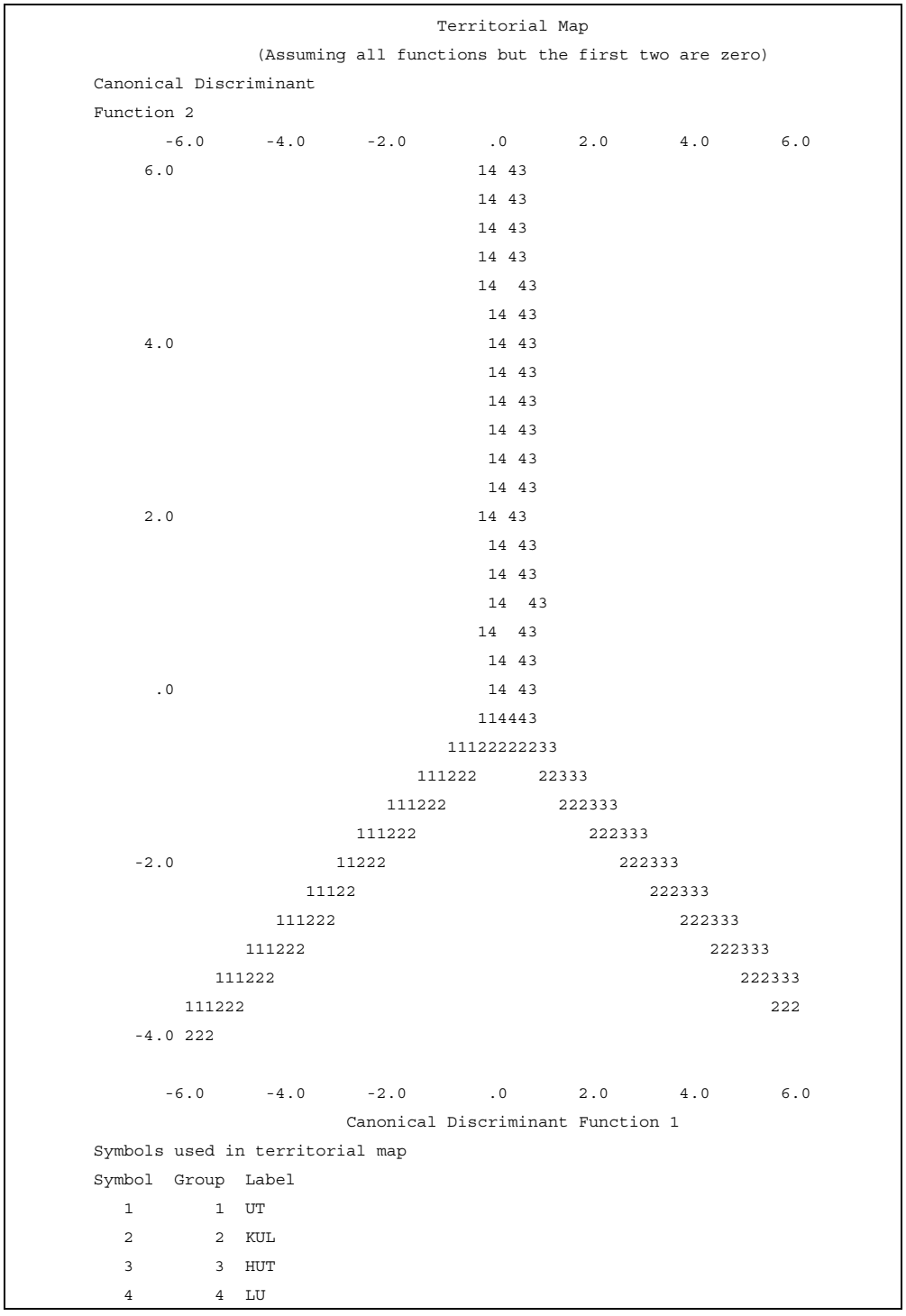

Figure 8 Territorial map universities, discriminant analysis old vs. new

From Figure 8 it is suggested that the assumption made on the basis of Figure 7 in relation to the difference between the UT and the HUT versus the KUL and LU can be verified. On Function 1 (the x-axis of Figure 8) there is a distinction between the UT (1) and the HUT (3). On Function 2 (the y-axis of Figure 8) there seems to be a distinction between KUL (2) and LU (4). These differences have to be treated with care, because of the spread within the groups that can cause variance in the results. But from this discriminant analysis it can be suggested that there is a distinction between the UT and the HUT on the one hand and the KUL and the LU on the other hand. These are interesting findings in relation to the sort of universities in this EUNITE case study. Therefore the next section, Section 8.5 describes the differences between the old and the new universities in more detail. Section 8.6 discusses the differences between the Nordic and the Dutch-Flemish universities.

8.5 Combining components and "old and new universities"

From the suggestions in the previous paragraph that there might be a difference between the old and the new universities with respect to using new forms of ICT in education, this section examines if these differences exist. Therefore an ANOVA was calculated to test the hypothesis that the group means of the old and the new universities are equal on the nine component scores. The means and standard deviations are given in Appendix I.

8.5.1 Differences related to the components

The results of the ANOVA analysis are presented in Table 96.

Table 96 Tests of Equality of group means old and new universities

	F	Sig.
Component 1, the new marketplace	2.130	.148
Component 2, the pedagogy for flexible learning	.123	.727
Component 3, the technology for flexible learning	5.314	**.024**
Component 4, students in a dynamic world	.004	.947
Component 5, concrete vision	1.083	.301
Component 6, workplace demands for new forms of ICT in education	2.125	.149
Component 7, individualisation	.837	.363
Component 8, cost-effectiveness	2.099	.151
Component 9, funding for support	.075	.784

From Table 96 it can be seen that there is no significant difference found for Component 1, the new marketplace, but this time the significance of difference is higher, although still not significant enough to conclude that there is a difference (0.148 compared to 0.47 in Table 93). Table 96 does suggest however that Component 2, 4 and 9 have the least difference between the old and the new universities. From this it can be concluded that regardless of whether a university is old or new the combination of ICT factors in Component 2 (offering flexibility, broad participation in the university, new conceptions of learning and teaching models with a focus on learner/learning, individual differences and active learning); Component 4 (part-time students, lifelong learning, competition and changing student demographics) and in Component 9 (funding and educational and technical support) are important. Almost all of these factors are perceived by 50% or more of the respondents as important (see Table 85).

Only on Component 3 (the technology for flexible learning) there is a significant difference between the means of the old and the new universities. From this observations it can be argued that Component 3 which was named "the technology for flexible learning" is a distinguishing component. The four separate universities have different perspectives on this component. From the post hoc analysis (as presented in Section 8.4.1, Table 94) it appeared that the UT and the HUT have different perceptions on this component than the KUL and the LU (see also Appendix I). This is further analysed in the next section.

8.5.2 ICT factors per component

Factors that were clustered in Component 3 are emerging technology, new technology (push, hype), administrative support, availability technology and availability facilities. Table 97 shows the ICT factors that are indicated as important for new and old universities.

Table 97 ICT factors for component 3 for old and new universities

ICT factor in Component 3	Percent of sample old universities (factor is indicated as important)	Percent of sample new universities (factor is indicated as important)
Availability technology	69	75
Availability facilities	58	79
New technology (push, hype)	50	54
Emerging technology	50	56
Administrative support	36	58

Table 97 shows that the factors availability technology, availability facilities, new technology (push, hype) and emerging technology are mentioned by at least 50% of the respondents in both the old and the new universities. Administrative support however scores high at the new universities (58%) and low at the old universities (36%).

From the results in Table 96 and the ICT factor comparison in Table 97 it can be argued that Component 3, the technology for flexible learning, is the component that is most distinguishing between the old and the new universities and that the most differentiating factor between old and new universities within this component is the availability of administrative support. This type of support was described in Chapter 3 as support from administrators, for example in the form of faculty-wide policy and offering incentives and resources. It was stated that for the implementation of an institution-wide implementation of ICT to be successful, central support services are needed to effect the change.

Obviously this conclusion can only be drawn in relation to Component 3 and the difference between the old and the new universities.

8.5.3 Implementation of new forms of ICT

The new form of ICT that has been chosen and the level of implementation at the old and the new universities is presented in Table 98.

Table 98 The implementation of new forms of ICT at old and new universities

New form of ICT	Level of implementation	Percent of sample New university	Percent of sample Old university
Only an electronic learning environment	Coordinated and supported activities	50	50
	integrated in teaching and learning	100	0
Only Websites	incidental, one or more teachers	0	100
	increasing awareness, at all levels	0	100
	coordinated and supported activities	50	50
Only computer-based training	increasing awareness, at all levels	100	0
Only videoconferencing	incidental, one or more teachers	0	100
Combination of applications	incidental, one or more teachers	100	0
	increasing awareness, at all levels	27	73
	coordinated and supported activities	72	28
Combination of applications including an electronic learning environment	coordinated and supported activities	61	39
	integrated in teaching and learning	83	17

From Table 98 it can be seen that the new and the old universities differ in relation to the level of implementation of new forms of ICT in education. The most apparent difference seems to be related to the step from coordinated and supported activities to integrated in teaching and learning. Looking for instance at the implementation of a combination of ICT applications the old universities have high scores related to the increasing awareness of the possibilities of new forms ICT in education and the new universities on the coordinated activities for the implementation. The level of implementation of the combination of ICT applications including an electronic learning environment differ in the same way: the old universities tend towards coordinated activities for the implementation while the new universities have a tendency towards an integrated approach to new forms of ICT in teaching and learning. From these results it seems possible to conclude that the new universities (the UT and the HUT) are more directed towards higher levels of implementation when it comes to combinations of ICT applications and electronic learning environments.

8.6 Combining components and “Nordic and Dutch-Flemish universities”

To test the hypothesis that the group means of the Nordic and Dutch-Flemish universities are equal an ANOVA is calculated again. The means and standard deviations are given in Appendix I.

8.6.1 Differences related to the components

The results of the ANOVA analysis is presented in Table 99.

Table 99 Tests of Equality of group means Nordic and Dutch-Flemish universities

	F	Sig.
Component 1, the new marketplace	0.17	0.678
Component 2, the pedagogy for flexible learning	2.00	0.161
Component 3, the technology for flexible learning	2.27	0.136
Component 4, students in a dynamic world	3.38	0.069
Component 5, concrete vision	3.65	0.059
Component 6, workplace demands for new forms of ICT in education	7.72	**0.007**
Component 7, individualisation	0.00	0.988
Component 8, cost-effectiveness	3.60	0.061
Component 9, funding for support	2.55	0.114

Again, from Table 99 it can be seen that there is no significant difference on Component 1 between the Nordic and Dutch-Flemish universities. There is also almost no difference between the universities on Component 7, individualisation. This could mean that the clustered ICT factors on this component (on-demand training, tailor-made products, knowledge management, improved access to education) are equally important or unimportant for Nordic and Dutch-Flemish universities. Table 85 shows that the last option is the case. Except for improved access to education the ICT factors in Component 7 are factors that are mentioned by less than 30% of the respondents.

There is one component on which the Nordic and Dutch-Flemish universities have a significant differences in means. This is Component is 6 (demands for ICT in education). This is further analysed in the next section.

8.6.2 ICT factors per component

Factors that were clustered in Component 6 (workplace demands for new forms of ICT in education) were demands from employers, demands from learners and dependence on IT. The clustered factors for the Component 6 are presented in Table 100.

Table 100 Clustered factors for Component 6 for Nordic and Dutch-Flemish universities

Component	Clustered factors	Percent of sample Nordic universities	Percent of sample Dutch-Flemish universities
6	Demands from employers	32%	24%
	Demands from learners	59%	33%
	Dependence on IT	54%	22%

From Table 100 it can be seen that for Component 6 the main difference appears to be in the scores on the demands from learners and the perceived dependence on IT. The respondents from the Nordic universities have a higher score on these two factors.

8.6.3 Implementation of new forms of ICT

The new form of ICT that has been chosen and the level of implementation at the Nordic and Dutch-Flemish universities is presented in Table 101.

Table 101 The implementation of new forms of ICT at Nordic and Dutch-Flemish universities

New form of ICT	Level of implementation	Dutch-Flemish universities	Nordic universities
Only an electronic learning environment	coordinated and supported activities	50%	50%
	integrated in teaching and learning	100%	0%
Only Websites	incidental, one or more teachers	50%	50%
	increasing awareness, at all levels	50%	50%
	coordinated and supported activities	50%	50%
Only computer-based training	increasing awareness, at all levels	0%	100%
Only videoconferencing	incidental, one or more teachers	100%	0%
Combination of applications	incidental, one or more teachers	0%	100%
	increasing awareness, at all levels	60%	40%
	coordinated and supported activities	22%	78%
Combination of applications including an electronic learning environment	coordinated and supported activities	68%	32%
	integrated in teaching and learning	83%	17%

From Table 101 it can be seen that a similar difference between the Nordic and Dutch-Flemish universities can be seen as was the case for the old and the new universities. This difference is related to the level of implementation. In the case of the Nordic and Dutch-Flemish universities there seems to be a tendency towards higher levels of implementation at the Dutch-Flemish universities in relation to implementing a combination of ICT applications and this combination including an electronic learning environment.

In the next section the components are combined with the perceptions of the three different groups of respondents, policy, support and education.

8.7 Combining components and the roles of the respondents

The component scores that were saved during the principal component analysis were used to find information about the combination of the components (described in Section 8.3) and the universities where the case studies were carried out (described in Section 8.4). In this section principal component analysis is used to find information about the combination of the components and the roles of the respondents that were interviewed during the case studies. By performing an ANOVA analysis it is possible to determine which components have a relation with the three groups of respondents. An ANOVA analysis was carried out to test the hypothesis that the group means on the nine component scores of the three groups of respondents are equal. The means and standard deviations are given in Appendix I. The results are presented in Table 102.

Table 102 ANOVA, Roles of respondents

	Sig.
Component 1, the new marketplace	.242
Component 2, the pedagogy for flexible learning	.299
Component 3, the technology for flexible learning	.881
Component 4, students in a dynamic world	**.044**
Component 5, concrete vision	.846
Component 6, demands for new forms of ICT in education	.060
Component 7, individualisation	.372
Component 8, cost-effectiveness	.791
Component 9, funding for support	.105

From Table 102 it can be seen that there is no significant difference on Component 1, but more convincingly not so on Component 3 (emerging technology, new technology administrative support, availability of technology, availability of facilities); Component 5 (shared vision, concrete plans and benefits) and Component 8 (new organisational structure, reducing costs and cost-effectiveness). From the results of in Table 102 in combination with the results of Table 85 it can be concluded that Component 3 is probably approximately equally important (over 48% of the respondents perceive these factors as important) and Component 8 approximately equally unimportant (less than 36% of the respondents perceive these factors as important) for the three groups of respondents. It is more difficult to say something about Component 5, because the percentage of respondents that perceive the ICT factors shared vision, concrete plans and benefits as important lies somewhere between 20 and 50%.

The only significant difference in the means of the three groups of respondents was found on Component 4 (students in a dynamic world), but the post hoc test for this component did not result in a significant difference between the three groups (policy, support and education) of respondents. The results of the cross-site analysis as presented in this chapter are summarised in the next section.

8.8 Summary and synthesis of cross-site analysis

This section gives an overview of the results of the cross-site analysis. The data of the four individual case studies that were described in Chapter 7 were combined in one data set which was used for the cross-site analysis that has been described in this chapter. A short overview of the general findings of Section 8.2 will be given in Section 8.8.1. Section 8.8.2 will summarise and integrate the findings of the sections that were related to the nine components that were extracted (Sections 8.3-8.7).

8.8.1 Findings from the overall EUNITE case study

Summarising the general results of the overall EUNITE case study it can be concluded that a combination of ICT applications (sometimes accompanied by an electronic learning environment) is the most common form of ICT use. In the majority of the cases the combination of ICT applications consists of Websites for learning-related purposes combined with domain specific tools and computer programmes. The majority of the respondents indicate that the implementation scale at the universities is at the level of

coordinated and supported activities. Only a small proportion of the respondents indicate that ICT has been integrated in the standard teaching and learning processes.

There is a tendency towards social motives for using and supporting a (new) form of ICT in education, the majority of persons involved are internal and the implementation of new forms of ICT has been voluntary. There are mixed feelings about the change that new forms of ICT has brought to the delivery of education and about the context of the university. With regard to the constituents, the content and the control of the change there is not much difference in the answers of the three groups of respondents. The main differences between the three groups of respondents appear to be related to the cause and the context of the change. With regard to the cause of the change the majority of the policy respondents indicate that social motives form the basic reason to use new forms of ICT in education, only two-thirds of the support persons and a little more than half of the education persons agree with this. With regard to the question related to the context, the policy and the support persons are about equally divided, but two-thirds of the education respondents indicate that they are uncertain about the context of their situation. It has been argued that these conclusions are related with each other. From the results it appears that instructors feel that educational and technical support and the availability of support facilities are of major importance, but they perceive less coordinated activities available for the implementation of new forms of ICT in education than the policy and the support persons. Furthermore even though there are primarily social reasons for using new forms of ICT in education economic reasons could play a role in the case when the respondents perceive their environment or context as unstable and try to respond to these uncertainties.

Wit regard to the profiles, Profiles 1 and 2 seem to be the profiles in which most of the respondents fit. The majority of the policy respondents are associated with Profile 2, the majority of the support respondents are divided between Profiles 1 and 2 and the majority of the education respondents are associated with Profile 1 and 3.

8.8.2 Findings related to the 9 components

In Section 8.3 nine components were identified that express the underlying variation in the original variables. These components are:

1. The new marketplace
2. The pedagogy of flexible learning
3. The technology for flexible learning
4. Students in a dynamic world
5. Concrete vision
6. Workplace demands for ICT in education
7. Individualisation
8. Cost-effectiveness
9. Funding for support

In Sections 8.3-8.7 several methods of statistical analysis were used to compare the following group means in relation to the nine components: (a) group means of the four universities, (b) group means of the old and the new universities, (c) group means of the Nordic and the Dutch-Flemish universities and (d) group means of the roles of the respondents.

The analysis of the group means of the four universities resulted in differences in group means on Components 3, 5 and 6. The analysis of the group means of the old and new universities resulted in a difference in group means on Component 3. The analysis of the group means of the Nordic and the Dutch-Flemish universities resulted in differences in group means on Component 6 and the analysis of the group means of the three groups of respondents resulted in differences in group means on Component 4. From these results it appears that:

- The universities do not significantly differ on Components 1 (the new market place), 2 (the pedagogy of flexible learning), 4 (students in a dynamic world), 7 (individualisation), 8 (cost-effectiveness) and 9 (funding for support). Especially the results related to Component 1 are interesting, because the clustered ICT factors in this component account for much of the variance (almost 17%). From the results is was concluded that the four universities perceive the ICT factors that are clustered in Component 1 about equally important, on average the factors are perceived as important by approximately 35% of the respondents.
- Comparing the four universities as one group and the old and new universities it can be seen that they have in common that they do not differ significantly with regard to Component 1, but the old and new universities differ significantly in relation to Component 3. This was described in more detail in Section 8.5.
- Comparing the four universities as one group and the Nordic and Dutch-Flemish universities it can be seen that again there is no difference between the two groups of universities in relation to Component 1, but that there are significant differences in relation to Component 6. In addition to this component the Nordic and Dutch-Flemish universities have a different perception on Component 4. This was described in more detail in Section 8.6.
- The three groups of respondents have no significant differences in relation to the nine components. This was described in Section 8.7.

8.8.3 Findings related to the implementation of new forms of ICT in education

Chapter 7 described the differences in choice for a specific form of ICT in education and the level of implementation at the four individual universities. In this chapter the same analysis was carried out for the old and the new universities and for the Nordic and Dutch-Flemish universities. From the results of the analysis it can be concluded that the new universities and the Dutch-Flemish universities have a higher level of implementation of several new forms of ICT in education. The combination of new universities and Dutch-Flemish universities results in the conclusion that it is primarily the University of Twente that has reached higher levels of implementation, especially related to a combination of ICT applications and the electronic learning environment TeleTOP. This confirms the findings of Chapter 7, related to the level of implementation and probably also related to the ICT factors that are perceived as important and the enforcement that is used to implement TeleTOP as the campus wide electronic learning environment. With these results and those of Chapter 7, Section 7.7, conclusions and recommendations for further research can be described. This is presented in the next chapter.

9 Conclusions about using new forms of ICT in education: stimulating the change process

Each of the chapters in this dissertation ended with some key elements or a synthesis that described the main topics that were discussed in that specific chapter. Based on these topics several conclusions can be prepared in relation to the research question and the subquestions as presented in Chapter 1. The overall research question was formulated as

"(a) Which factors effect change processes in universities with regard to implementing a new form of ICT in education, and (b) what effect does the choice for this form of ICT have on the implementation of ICT in education in the faculties and departments?"

In this final chapter of this dissertation about using new forms of ICT in education and organisational change conclusions are drawn from the results of the study and the research question is answered. Conclusions related to organisational change are described in Section 9.1 and conclusions related to ICT in education in Section 9.2. In Section 9.3 the applicability of what has been the result of the study is described.

9.1 Conclusions related to organisational change

In this study it was assumed that the process of adopting a new form of ICT in education and implementing this form of ICT occurs in an organisational unit within a higher education institution. It was argued that the increasing use of ICT in education can be seen as a major change. Change, formulated as a step in time during which something of substantial importance to the operating procedures of an organisation has changed, consists of three stages: initiation, implementation and institutionalisation. In this study the process of change involves both the decision to adopt or to evolve toward new forms of ICT in education, the implementation of these new forms of ICT and the integration of new forms of ICT in teaching and learning processes.

The process of organisational change is not unique for adopting a new form of ICT in education, but can be described in more general terms. The first sub-questions to be addressed in this study were: *'How can organisational theories help understand change processes in universities?'* and '*How can these theories be applied to the decision to implement and integrate new forms of ICT in education?*'

9.1.1 Organisational change theories

In this study Institutional Theory and Resource Dependency Theory have been chosen to form the theoretical basis for organisational change. These theories provided different insights into why and how organisations react to changes, as well as providing some common characteristics of reactions of universities to change that are used throughout this research. From the two theories it can be confirmed that universities and their faculties and departments, react in a specific way to internal and external pressures. Oliver's research (Oliver, 1991) in relation to the factors that predict responses or strategies and the degree of organisational congruity or resistance to internal and external pressures was used.

Combining Institutional Theory and Resource Dependency Theory resulted in five questions related to organisational change that were used throughout this study. These questions were:

1. Does the university perceived itself as being pressured to use new forms of ICT in education? And if so, Why? (the cause of the change)
2. Who is exerting this pressure on the university? (the constituents of the change)
3. To what norms or requirements in relation to new forms of ICT in education is the university being pressured to conform? (the content of the change)
4. How or by what means are the institutional pressures in relation to using new forms of ICT in education being exerted? (the control of the change)
5. What is the environmental context in relation to new forms of ICT in education within which institutional pressures are being exerted? (the context of the change)

The insights of the two organisational change theories have been useful for establishing the framework of this dissertation. In particular the combination of the two theories and the five organisational change questions that were the consequence of this combination have proved to be helpful. The conclusions related to the five organisational change questions are described in Sections 9.1.2-9.1.6.

9.1.2 The cause of change

For the four individual universities that were involved in the case studies there is a tendency towards social motives for using and supporting a (new) form of ICT in education. These social motives include the idea that with the support of ICT applications the quality of education can be enhanced and that the support of the learning process of the students can be improved. The economic reasons that were mentioned in the results of the study at the four universities were primarily related to using new forms of ICT to attracting more students. It was concluded that even though the majority of the policy respondents indicate that social motives form the basic reason to use ICT in education, only two-thirds of the support persons and a little more than half of the education persons agree with this. Some of the respondents from the education group indicated that they expect to gain time and invest less effort if ICT is used in teaching and learning processes.

Conclusion: Social motives are the prime incentive to use new forms of ICT in education. Instructors expect more economic benefits (especially related to less time investments and attracting more students) from the use of new forms of ICT in education than policy makers.

9.1.3 The constituents of change

There is not much difference between the universities in relation to the constituents of the change, interpreted as internal versus external involvement in the decision to use new forms of ICT in education. The majority of the respondents indicated that the persons involved in the process of using and supporting new forms of ICT in education are internal constituents. The results of the interviews indicated that the involvement of internal constituents is important. As has been described in Chapter 1, Section 1.2, in the initiation phase a pioneer or an innovator is needed, someone to explore the possibilities of a specific ICT application and to share the experience with others. This person is also important during the implementation phase, primarily to stimulate further innovation and to generate a commitment from a broader group of staff, but here a decision or policy maker is also

essential. If the university wants to evolve beyond the pioneering phase the decision maker has to make the choice to use the application on a wider scale and how to involve the staff at the university to accomplish this.

This is what has been seen most obviously in relation to the results of the University of Twente. An innovator at the Faculty of Educational Science and Technology, who had experienced for several years with Web-based learning, assembled a team to design and develop the TeleTOP system. This system was first adopted by the management of the faculty who made the decision to implement TeleTOP throughout the faculty. This resulted in a broad participation on faculty level and in a wide interest in the other faculties of the universities. In consequence this resulted in a bottom-up process of faculties that wanted to use TeleTOP in their education as well and in a top-down process of policy making and strategic planning of TeleTOP at the central level of the university, including the provision of the necessary resources and educational and technical facilities.

Conclusion: The actors that steer the adoption and implementation of new forms of ICT in education come from within the university. These persons are the pioneers and the decision makers and have influence in different stages of the change process. The pioneers influence primarily the initiation stage. If the organisation wants a faculty- or university-wide implementation, it is important that the decision makers makes this decision to implement the new form(s) of ICT in education. The decision makers can also expected to be the right person to influence the institutionalisation stage, for instance by policy and/or offering resources.

9.1.4 The content of change

There are mixed feelings about the change that new forms of ICT has brought to the delivery of education. The respondents of all three groups are divided about the question related to the content of the change: about 50% of all three groups indicate that using new forms of ICT has brought a change in educational delivery, but the other half disagrees. Most of the respondents indicate that this is because time is needed to get used to the idea of using new forms of ICT in education. Instructors have to learn to deal with the enormous possibilities of the technology. Next to this it has been concluded that the institutionalisation or integration of new forms of ICT in education require both the necessary facilities and support persons as some kind of enforcement to use these new forms of ICT. This is further described in Section 9.2.

Conclusion: New forms of ICT can bring a change in the way education is offered and supported, but this has not manifested itself on a large scale thus far. Instructors need time, support and sufficient resources to use new forms of ICT appropriate in education. This relates to the importance of the availability of facilities and support described in the next section.

9.1.5 The control of change

The University of Twente is the only university in this study for which it can be stated that coercion or enforcement to use new forms of ICT in education has been perceived by the majority of the respondents. At the other universities the number of respondents that indicated coercion is minimal and the implementation of new forms of ICT has been voluntary. Associating this with the level of implementation it can be deducted that the level

of enforcement can have its influence on the implementation scale: the UT is the only university in which the respondents indicate a high level of integration of ICT in the teaching and learning process. This is further described in Section 9.2.

Conclusion: From the results of the case studies it appears that it is not custom for universities to enforce the decision to implement ICT at a large scale in the university. But in the event that enforcement is applied a higher level of integration of ICT in the teaching and learning process may well be achieved.

9.1.6 The context of change

With regard to the context of the change there are differences between the universities. The majority of the respondents of the UT perceive the context of the university as uncertain. This is related to diminishing student numbers and funding and to reorganisation of parts of the university. Half of the respondents from the KUL and the HUT perceive their environment as reasonably stable, the other half sees some uncertainties, again related to diminishing numbers of students and funding. The majority of the respondents at the LU perceive their environment as stable or certain. In relation to the perception of the groups of respondents it was concluded that the policy and the support persons are about equally divided, but two-thirds of the education respondents indicate that they are uncertain about the context of their situation. However, most of the respondents indicate that ICT will have just a minor role in solving this uncertainty.

Conclusion: Even though the respondents indicated specific ICT-related environmental pressures to use new forms of ICT in education, the perception of the respondents on the general context of the university does not seem to have a direct influence on the use of new forms of ICT in education. On the other hand Chapter 8 described the importance of Component 1, the new market place, a combination of environmental ICT factors that seems to be equally important to all universities. This is further described in Section 9.2.
These statements are further elaborated in the next section in which conclusions related to the factors that can have an effect on the use of new forms of ICT in education are described.

9.2 Conclusions related to new forms of ICT in education

This section describes the conclusions related to new forms of ICT in education. First the most important factors that have an effect on the use of new forms of ICT in education are described in Section 9.2.1. Conclusions related to using and implementing specific forms of ICT in education are given in Section 9.2.2 and Section 9.2.3 describes the consequences of the study in relation to profiles of ICT use at universities.

9.2.1 Factors that have an effect on the use of new forms of ICT in education

Choosing for supporting a specific form of ICT in education does not only involve decisions about technology and teaching and learning processes; it is also part of an institutional strategy. Therefore sub-question 4 that was formulated in Chapter 1 in relation to influences on the broader strategic choice was: *Which factors have an effect on the decision to adopt or support a specific form of ICT in education at a particular university?*

From the results of the case studies it can be concluded that:

- Factors that are mentioned by at least two-thirds of the respondents are new conceptions of learning, availability technology, active learning, availability facilities, educational and technical support and flexibility. Three of these factors relate to the category availability of support facilities, one to educational developments and one to environmental pressures.
- Factors that are of minor importance and are mentioned by less than 25 % of all respondents are education as business, tailor-made products, (new) organisational structure and knowledge management. The factor that was mentioned least was reducing costs.

There were some differences between the universities in relation to the importance of the factors. While at the UT the availability of support facilities was stressed as most important, the K.U. Leuven and the HUT were more interested in educational developments. The respondents of the LU indicated a combination of the availability of support facilities and educational developments as important. This does not mean that the UT is not concerned with educational developments or that the K.U. Leuven and the HUT think that support facilities are not important. It is more a question of where the university stands at this moment in time, related to the life cycle of a technology innovation in education as described in Chapter 1, Section 1.2. This is described in the next section.

9.2.2 Using and implementing specific forms of ICT in education

In the study it was of particular interest to systematically identify which forms of ICT are being chosen by the universities and how these relate to certain profiles of a university. The sub-question 3, 6, 7 and 8 related to these issues were formulated as

3. What are major forms of ICT use in universities?
6. What effect does the choice of a specific form of ICT have on the implementation of this form in the faculties and departments?
7. Which forms of ICT are actually implemented in faculties and departments?
8. What conditions influence the implementation of these forms of ICT in different educational settings?

Major forms of ICT use at the four universities where the case studies have been carried out were identified in Chapters 7 and 8. A combination of ICT applications (also including an electronic learning environment) is the overall form of ICT that is most used and supported at the universities. It was observed that all universities make heavy use of combinations of ICT applications, in two cases, at the UT and the LU, this includes a wide-spread use of an electronic learning environment. The KUL and the HUT also make use of combinations of applications, but the number of respondents that use an electronic learning environment is very small.

From the results of the case studies it can be concluded that almost 60% of the respondents of the UT have indicated that there are at least coordinated and supported activities for ICT implementation and that 40% of the respondents state that ICT has been integrated in the teaching and learning processes. The other universities do not indicate that they have this scale of implementation. The LU comes closest to the level of implementation that has been reached at the UT. A substantial percentage of respondents at the KUL (almost 60%) state

that there is an increasing awareness of ICT relevance and possibilities at all levels, but there are no respondents that indicate that ICT has been integrated in the teaching and learning processes. This is also the case at the HUT, but at that university the proportion of respondents that indicated that there are coordinated and supported activities for ICT implementation is much higher (29% at the KUL and 67% at the HUT).

For a better understanding of the meaning of the forms of ICT that are used and the scale of implementation at the different universities we return to what has been said in Chapter 1 about the life cycle of a technology innovation in education. These cycles are (pre-) initiation, implementation and institutionalisation, or as has been used as operationalisation of these stages throughout this study: (a) incidental and isolated use of ICT by one or more instructors, (b) increasing awareness of ICT relevance and possibilities at all levels, (c) coordinated and supported activities for ICT implementation and (d) using new forms of ICT integrated in teaching and learning. Relating this to the factors that have an effect on the use of new forms of ICT in education it can be concluded that universities at a further stage of implementation (coordinated and supported activities for ICT implementation and using new forms of ICT integrated in teaching and learning) will stress the importance of support facilities, educational developments and technology developments and at the lower stages of implementation (incidental and isolated use of ICT by one or more instructors and increasing awareness of ICT relevance and possibilities at all levels) the university is more likely to be influenced by educational developments, environmental pressures and technology developments. From this it can be concluded that the two universities with a higher level of implementation put more emphasis on support facilities and the two universities with a lower level of implementation are more influenced by environmental pressures.

A similar analysis has been carried out for the new and old universities and the Dutch-Flemish and Nordic universities. From the results of this analysis the conclusions as written down above can be confirmed. The new and the Dutch-Flemish universities have higher levels of implementation of new forms of ICT, compared to the old and the Nordic universities.

Another way to examine this has been done in the form of profiles of universities that can be predicted based on the outcomes of the answers to the five organisational change questions and the indication of importance of the ICT factors that have an effect on the use of new forms of ICT in education. in addition to the profiles nine components were extracted. Conclusions about the profiles and the components are described in the next section.

9.2.3 Profiles and components of ICT use at universities

Sub Research Question 5 that was formulated in Chapter 1 in relation to profiles of ICT use at universities was presented as *What are the key variables in profiles of universities that follow alternative ways to support ICT in education?*

The first set of profiles was defined in Chapter 5 and examined in Chapters 5, 6, 7 and 8. These profiles were defined in relation to the cause of the change and the context of the change as presented in Figure 4.

	Uncertain context	Interconnected context
Social cause	**Profile 1: Supporting learners in a changing world**	**Profile 2: Developing expertise in the institution**
Economic cause	**Profile 3: Surviving in a competitive world**	**Profile 4: evolving to a cost-effective approach in education**

Figure 9 The four profiles
(repeated from Figure 4, Section 5.4)

From the results of the cross-site case study it was concluded that the UT and the HUT have the majority of the respondents in Profile 1, and the KUL and the LU in Profile 2. In addition to the profiles that were defined in Chapter 5 it was identified which factors most discriminated the profiles. This was tested in Chapters 7 and 8 for the four universities and for the overall EUNITE case study. From that research it was determined that for each university different factors were found as important within the four profiles. This meant that another way of describing profiles had to be found. This was done by generating nine components via a principal components analysis as described in Chapter 8, Section 8.3, and giving them the following names:

1. The new marketplace
2. The pedagogy of flexible learning
3. The technology for flexible learning
4. Students in a dynamic world
5. Concrete vision
6. Workplace demands for ICT in education
7. Individualisation
8. Cost-effectiveness
9. Funding for support

Several methods of statistical analysis were used to compare the following group means in relation to the nine components: (a) group means of the four universities, (b) group means of the old and the new universities, (c) group means of the Nordic and the Dutch-Flemish universities and (d) group means of the roles of the respondents.

This resulted in the observations that the universities do not significantly differ on Components 1, 2, 4, 7, 8 and 9. The old and new universities have significant differences in relation to Component 3. The Nordic and Dutch-Flemish universities have significant differences in relation to Component 4. The three groups of respondents have no significant differences in relation to the components.

The following conclusions related to profiles and components of ICT use at universities is therefore formulated: Profiles (and components) give an indication of situations or scenarios that could happen. They are not to be used to directly associate a specific university with its

own context and culture into one of the profiles. Profiles can indicate however in which direction the university is going. Profiles can therefore help both researchers and decision-makers to establish the goals of a university, to determine which direction the university wants to go and which possibilities and potential threats can be encountered. Identifying important distinguishing factors within the profiles and components can increase the value of the profiles. Even though not all of the distinguishing factors will be apparent for various universities, they can give an indication about the direction of the plans and strategic decisions that have to be taken. The profile itself merely indicates the destination of the university, the factors determine the route towards the destination.

Based on the conclusions in Sections 7.7, 9.1 and 9.2 the final step in this study is taken: from research to practice.

9.3 Stimulating the change process

The ultimate goal of doing research is to apply the findings of the study to an appropriate setting. With the object of research in this study, using new forms of ICT in education, this is a distinct possibility. Factors that have an effect on change processes in universities with regard to implementing and integrating a new form of ICT in education have been identified. Following this the effect of the choice for a specific form of ICT in education on the implementation of ICT in the faculties and departments has been described. The most obvious way to use this information is to find a practical setting in which the results can be used. This setting can be related to policy and the person who has to write and communicate the strategic plans and documents. But an even more practical situation is that of the person who is held responsible for the large-scale implementation of ICT in education at a university, usually the ICT coordinator. For this specific person at a university the following plan is written as an indication of steps that have to be taken if the university wants to stimulate the change process of integrating ICT in the teaching and learning processes.

While writing the implementation and integration plan the following characteristics of the ICT coordinator are considered. The ICT coordinator is the person who works at a central unit of the university, probably the educational centre, the centre for innovative learning or maybe the more technologically oriented centre for information technology in education. She has knowledge of educational and didactical issues related to ICT in education, but is also aware of the technological possibilities of different kinds of systems. Furthermore, she has been involved in different groups at the university related to ICT in education and is therefore aware of what is happening at the university. In addition to these activities she plays an advisory role in the process of policy and strategic decision making at the university level. All in all, a typical busy ICT coordinator.

As is the case in many universities the ICT coordinator has been involved in many pilot projects related to new forms of ICT in education. Most of these projects relate to Web-based or networked technology. Based on the experiences that came out of the projects and because of several pressures from within and outside the university it has been decided at the central level of the university that the unit where the ICT coordinator is employed will be responsible for implementing a university-wide electronic learning environment. The ICT coordinator and her team are in charge of this ambitious plan.

Fortunately the ICT coordinator does not have to start from scratch. She and her team have been involved in the pilot projects and know to a certain extent what has happened in the different faculties and departments. But how to proceed to the next level of implementation and integration? The ICT coordinator uses the following plan.

9.3.1 Step 1: Establish the motives

The first step that has to be taken is to get informed and to establish the motives. Why does the university wants to implement a university-wide electronic learning environment? Does the university perceived itself as being pressured to use new forms of ICT in education? And if so, Why? What is the environmental context in relation to ICT in education? In other words, the ICT coordinator has to establish what the mission and the vision of the university are in relation to new forms of ICT in education. This information is however not sufficient. The mission and the vision of the university may not have been communicated adequately to the faculties and/or departments. Therefore the ICT coordinator will have to schedule meetings with the faculty deans and the heads of departments. These meetings have a twofold objective. The first objective is related to 'getting informed': to get acquainted with the faculty and the influential persons, to get to know the ideas and opinions that exist in the faculty in relation to ICT in education and to become informed of existing examples of ICT applications. The second objective is related to 'inform them': let the faculty and the persons get acquainted to her and the implementation team, inform them about the possibilities that can be offered in relation to support and facilities, let them know how to find her if needed.

Other activities that are necessary in this step are also related to information and in particular to information sharing. Possibilities are to establish a network of ICT-support persons from the faculties, organising workshops and discussion meetings about the use of new forms of ICT at this specific university or about experiences from others. The main objective for these kinds of activities is to keep the others (the persons from the faculties) and herself informed and involved.

> In Step 1 the organisational change questions 1 (the cause of the change) and 5 (the context of the change) are used in relation to the categories of ICT factors that can have an influence on the decision to use a new form of ICT in education in combination with the results of the case studies. From the cause of the change it has to be kept in mind that even though in general there is a social motive to use new forms of ICT in education instructors, policy makers and support persons can also have an economic motive. Often these two motives are related. It is important to discuss both topics with the faculty deans and the heads of departments. bringing both subjects to the attention of the deans and heads will result in a growing awareness of the possibilities of new forms of ICT in education and the deans and heads will be able to translate the arguments to their academic staff. The categories of ICT factors are not meant as a 'handout', but as a checklist for the coordinator to structure the meeting, to be prepared for questions and to demonstrate the deans and heads on the various possibilities of responding to the growing need of using new forms of ICT in education.

9.3.2 Step 2: Determine the target

Usually the goals, mission and vision of a university in relation to ICT in education are stated in a policy paper or strategic plan, but it is often unclear what the final norms or

requirements are. Implementing an electronic learning environment is a very broad assignment. Therefore it is important to develop an implementation plan based on the goals, mission and vision of the university and on the budget that is available for this project. The implementation plan will differ for each university, but should at least justify the decision to start the project, give an overview of what is going to be implemented (the electronic learning environment), give an indication of the schedule of implementation and of the available resources and support. Support in many different forms will be the major part of the project plan. The support (such as workshops, training and individual assistance) should be available for everyone who wants to (or has to) use ICT and the electronic learning environment. The plan should translate the objectives of the project into elements that are important for the faculties and the staff members. This will increase the possibility of success.

In Step 2 organisational change question 3 (the content of the change) is used in combination with the results on this question of the case studies and the results on the questions related to the level of implementation of the new forms of ICT in education. The target for the department, faculty or university can be at the level of integrating new forms of ICT in the teaching and learning processes, but it will not be the case for every organisational unit. In relation to this the ICT coordinator has to assist the unit in deciding whether the integration of ICT and possible institutionalisation will be the target at all. It can be imagined that in some cases it is sufficient to explore possibilities and carry out some pilot projects. But in the event that the department, faculty or university wants to reach higher objectives an implementation plan is necessary. This implementation plan should account for the options as mentioned above, and should account for what has been observed in the results of the case studies: the implementation of new forms of ICT will not necessarily lead to a change in the way education is offered and will not lead every time to an integration of ICT in teaching and learning.

9.3.3 Step 3: Identify the stars

When talking to the decision makers at university and faculty level and to staff members in the faculties try to identify ‘the stars’, the pioneers, the enthusiastic instructors that have been using new forms of ICT for some time and recognise its possibilities and potentials. These people are the key persons that can bring the use of new forms of ICT to a higher level. They can share their experiences with other instructors, acknowledge the problems and complications and identify solutions.

However, two important issues have to be noted here. First of all, the ICT coordinator and her team should have experiences themselves about what it means to use ICT in education. They are responsible for this large-scale implementation project and have to know what they are dealing with. Second, a pioneering instructor and a helpful coordinator are not enough to reach a large-scale implementation. A third person is needed, a person with influence and the possibility to make higher order decision, that is, decisions on the faculty level. These persons are key figures in the next step.

In Step 3 organisational change question 2 (the constituents of the change) is used in relation with the categories of ICT factors that can have an influence on the decision to use a new form of ICT in education in combination with the results of the case studies. From the results of the case study it appeared that the internal involvement of persons

from a university has the best influence on the decision to use new forms of ICT in education. Especially the existence of pioneers in a department or faculty has been indicated as very important. By supporting the pioneer with sufficient resources the implementation process can be accelerated.

9.3.4 Step 4: Exert pressure

The university or the individual faculties have to decide if the implementation of the electronic learning environment will be voluntary or planned. On first sight voluntary implementation seems to have the most advantages. Instructors do not feel pressured to do things they don't want or things they are not able to do. But this immediately brings out the pitfall in this way of implementing. If instructors are not pressured to use an electronic learning environment than many instructors will not use it. And that is understandable. It takes much time and effort to modify existing teaching and learning practices and there is much more to do than transforming the regular courses to ICT-based courses.

Therefore the previous step related to the objectives of the implementation is very important. If the university's or faculty's objective is to gain some experience with electronic learning environments than exerting pressure will probably not be needed. But if the university has a distinct idea about using an electronic learning environment for specific purposes (for example attracting new students or competing with other educational providers) decisions have to be made in relation to how or by what means the pressure is exerted.

In Step 4 organisational change question 4 (the control of the change) is used in relation with the categories of ICT factors that can have an influence on the decision to use a new form of ICT in education in combination with the results of the case studies. From the results of the case study it appeared that the respondents of the university with the highest perception of enforcement (the UT) indicated that at this university the highest level of implementation took place. From this it was concluded that some form of coercion or enforcement has a positive effect on the change process. The person to execute the enforcement is typically someone from the management, for instance a dean, an educational director or the rector/vice-chancellor.

9.3.5 Step 5: Offer resources

Regardless of whether the organisation is exerting pressure on instructors to use the electronic learning environment or not it is of absolute importance that instructors that do want to implement electronic learning environment in their education have sufficient support and resources. Without support facilities it is highly likely that only those instructors who are very enthusiastic or very ICT minded will (start to) use the learning environment. Again, this is acceptable for a university with the objective of gaining some new experiences, but not for the university that has a strategic rationale and vision and wishes to use a new form of ICT as a tool for reaching this vision.

Because the way support is offered to instructors has been described in the implementation plan the instructors know which kinds of support they can expect (and which kinds not). The kinds of support can range from one-day mini-conferences to workshops for specific target groups to individual assistance, based on the needs and skills of the instructors.

In Step 5 the categories of ICT factors that can have an influence on the decision to use a new form of ICT in education are used in combination with the results of the case studies. It was concluded from the results of the case study that the availability of both the facilities and technical and educational or didactical support is very important in the implementation and integration of new forms of ICT in education.

9.3.6 Step 6: Take a step back

Step 6, take a step back, can be taken literally or in the framework of this plan of steps. Starting with the latter, the ICT coordinator should take a step back to Step 5. See if the support that has been offered is sufficient and if other forms of support are needed. She should also take a step back to see if the objectives that have been set are still followed. She should keep an overview of the project at all times and not let herself become entangled in 'minor' problems or setbacks. She should find a person or a group of persons with whom she can discuss the day-to-day practice and with whom she can reflect with. In case of larger problems she also has to know on who she can fall back.

In Step 6 the categories of ICT factors that can have an influence on the decision to use a new form of ICT in education are used in combination with the results of the case studies. Next to the necessary extra attention for sufficient resources, the results of this study showed that the implementation and integration of new forms of ICT in education brings many aspects into the daily practice of persons from the policy, support and education groups. Many factors influence the change process. To keep on track and to keep ahead of problems the ICT factors that are important at a specific university should be accounted for and justified. Not only by the ICT coordinator, but also by hear team and her supervisor. Sharing experiences, establishing a clear communication structure and staying open for new ideas and options are the most important activities for the ICT coordinator.

9.3.7 Step 7: Evaluate and revise

If there is one kind of project that needs evaluation it is an implementation and integration project. It is out of the scope of this study to present a detailed planning of the evaluation of the implementation of a university-wide electronic learning environment, but the evaluation should at least include the following topics.

- An introduction to the project with the rationale for the decision to start the project, an overview of what has been implemented (the electronic learning environment) and what the future implementation aspects are and the schedule of implementation and of the available resources and support
- The goals of the evaluation
- The evaluation questions
- An overview of the evaluation method
- The planning of the evaluation
- The results of the evaluation
- Conclusion: what is going to be the next step, based on the evaluation results

It is recommended that the evaluation of the project is formative: an evaluation to improve the implementation and the integration process.

In Step 7 the five organisational change questions, the categories of ICT factors that can have an influence on the decision to use a new form of ICT in education and the information from the case studies about the level of implementation are used. In order to evaluate the implementation of a university-wide electronic learning environment information that was gathered in the previous six steps is needed. This means that information from several levels is required. First of all information from the level of the administration or the decision-making body at the university. The plans of the university with regard to implementing the electronic learning environment offer the evaluator the rationale and objectives of the implementation. Probably the cause, the constituents and perhaps the control of the change are mentioned in this plan. If the ICT coordinator is fortunate the plan will mention something about the content of the change related to integrating the new forms of ICT in the teaching and learning process, but the coordinator will know from experience that this might be to complex or to risky for policy makers to mention this topic.
With the policy paper or strategic plan from the level of the administration or the decision-making body at the university, the consequent implementation plan written by the ICT coordinator and her team and the discussions with the deans, the heads of the departments and the pioneers (Steps 1 and 3) the introduction and the goals of the evaluation can be written. Based on this information the evaluation questions will be formulated. The ICT coordinator will probably pay attention to questions related to the experiences from the instructors and the students. Topics of interest include instructors' time to learn how to use the electronic learning environment, the (didactical) way the electronic learning environment is used in education, the additional requirements from the instructors related to functionalities and examples of good practices. Another part of the evaluation will be more related to the experiences of the implementation team, such as the communication between the team and the instructors, the support that is offered to the instructor and the demands for support asked by the instructors, the pace of the implementation and technical requirements. The evaluation of the experiences of the students will also be an important aspect of the evaluation. Questions related to their perception of the usefulness of the electronic learning environment in education, the value of an electronic learning environment in different educational settings (regular, part-time, master programmes) and the use of communication possibilities (between students and between instructor and students) will be of interest.

From the beginning of the evaluation it should be clear what will be done with the results of the evaluation. This can relate to technical updates of the environment, but also to issues such as the support that will be offered to instructors in the future, the implementation of the electronic learning environment in the daily practice of the university and the ongoing effort to get more awareness of the possibilities of electronic learning environment as a new form of ICT in education in order to reach a full integration of ICT in the teaching and learning practices.

Following these steps during the process of implementing a new form of ICT in education, the ICT coordinator is better prepared to stimulate the change process that is needed to achieve new ways of ICT-supported teaching and learning.

Summary

Based on the fact that the environment of universities is constantly changing due to government- and policy-related pressures, market forces and demographic changes and adding to this the growing awareness of the potential offered by information and communication technology (ICT) to respond to these changes, the research question for this study was formulated as

"(a) Which factors effect change processes in universities with regard to implementing a new form of ICT in education, and (b) what effect does the choice for this form of ICT have on the implementation of ICT in education in the faculties and departments?"

'Using new forms of ICT in education' was defined as using all kinds of information and communication technologies to make connections among persons and resources that can be used to support the teaching and learning process. This definition does not limit ICT to Web-based or network technology, ICT can range from the World Wide Web and e-mail to videoconferencing, computer-based training and CD-ROMs. With this broad definition it is possible to identify factors that have an influence on the use of all these technologies.

The changes in the environment of the university are described in Chapter 1 and it was indicated that ICT is seen as a major response to changes, trends and stakeholders. In relation to this it was argued that using new forms of ICT in education is a change process. Change, described as a step in time during which something of substantial importance to the operating procedures of an organisation has changed, involves several stages: initiation, implementation and institutionalisation. The new forms of ICT will not be institutionalised in all universities, faculties and departments. Therefore a distinction is made in four levels of implementation: (a) incidental and isolated use of ICT by one or more instructors, (b) increasing awareness of ICT relevance for education at all levels, (c) coordinated and supported activities for implementation, and (d) ICT integrated in teaching and learning. It was further argued that there is a process of change involved in both the decision to adopt or to evolve toward a new form of ICT in education and in the implementation of these forms of ICT.

Change processes are not unique processes for universities and for implementing new forms of ICT in education. Therefore Chapter 2 describes two organisational change theories that form the basis for this research. The two theories described are Institutional Theory and Resource Dependency Theory. In Institutional Theory organisations are described as groups of people who embody and enact loosely coupled standardised packages of rules, procedures, and beliefs. Maintaining organisational legitimacy in the eyes of external bodies, such as government regulators, professional organisations, and powerful clients, contributes to the survival of the organisation. In Resource Dependency Theory organisations are described as flexible and the task environment, the social environment and the effect of state pressures on organisations have an influence on organisational change. Resource Dependency Theory rests on the fundamental assumption that, despite other goals and aims, all organisational action is first and foremost directed at securing institutional survival. To accomplish this organisations need resources to survive and the more control

over resources an organisation has, the more power the organisation has.
Even though the two theories are different from each other it is possible to identify both shared as well as divergent aspects. Resource Dependency Theory and the Institutional Perspective share two basic assumptions (Oliver, 1991): (a) organisational choice and action are influenced by external pressures and demands and (b) organisations must be responsive in order to survive. The two approaches do not converge on two central issues: (a) the extent of the capability to react to changes in the environment of the organisation and (b) the way to react to changes in their environment.

To identify the position of an organisation in relation to these shared and divergent aspects Oliver (1991) formulated five organisational change questions with answer dimensions. These questions and their related dimensions and answer values were adapted for this research into:

1. Does the university perceive itself as being pressured to use new forms of ICT in education? And if so, Why? (dimension: the cause of change)
   - Answer value 1, Social fitness: secure the legitimacy of the choice to conform to the change in relation to social motives (expectations, culture, habits)
   - Answer value 2, Economic fitness: secure the legitimacy of the choice to conform to the change in relation to economic motives (obtaining resources and funding, distribution of power)

2. Who is exerting pressure on the university? (dimension: the constituents of change)
   - Answer value 1, Multiplicity of constituent demands: involvement from (and consequently influence of) other (external) interested persons on the choice to change
   - Answer value 2, Dependence on institutional constituents: internal involvement in the choice to change

3. To what norms or requirements in relation to new forms of ICT in education is the university being pressured to conform? (dimension: the content of change)
   - Answer value 1, Consistency with organisational goals: the change to be implemented is conform with the current practice in the organisation
   - Answer value 2, Constraints imposed on the organisation: the change to be implemented requires that specific conditions are met that were not practised before

4. How or by what means are the institutional pressures in relation to using new forms of ICT in education being exerted? (dimension: the control of change)
   - Answer value 1, Coercion: the implementation of the change is enforced by an actor or institution within the organisation
   - Answer value 2, Voluntary: the implementation of the change is expected to proceed via a voluntary diffusion of existing norms and rules

5. What is the environmental context in relation to new forms of ICT in education within which institutional pressures are being exerted? (dimension: the context of change)
   - Answer value 1, Environmental uncertainty: the environment in which the change takes place is uncertain
   - Answer value 2, Environmental interconnectedness: the environment in which the change takes place is predictable

These five organisational change questions and their related dimensions and answer values form the basis for this research. In order to find answers to the questions that are related to ICT in education Chapter 3 describes factors can be of influence on the decision to use new forms of ICT in education. These factors were categorised in six categories: (a) environmental pressures, (b) technology developments, (c) educational developments, (d) institutional conditions, (e) cost reduction, and (f) support facilities. The complete list of factors is presented in Table 1.

Table 1 Summary of factors that effect using new forms of ICT in education

Category	Factors	
Environmental pressures	New market	Competition
	Education as business	Response to threats and opportunities
	Part-time students	Flexibility
	Lifelong learning	Knowledge management
	On-demand training	Changing student demographics
	Funding	Demands from employers
	Partnerships	Demands from learners
	Tailor-made products	
	Dynamic environment	
Technology developments	Emerging technology	New technology (push, hype)
	Dependence on IT	
Institutional conditions	New organisational structure	Concrete plans
	Broad participation	Improved access to education
	Shared vision	Leadership
Educational developments	New conceptions of learning	Individual differences
	New teaching models	Active learning
	Focus on learner/learning	
Cost reduction / Cost-effectiveness	Reducing costs	Benefits
	Cost-effectiveness	
Support facilities	Administrative support	Availability technology
	Educational and technical support	Availability facilities

Chapter 4 describes the combination of the organisational change theories and the (categories of) ICT factors and relates these to the research questions. To analyse the research questions a case study research strategy was applied. The first case study was a literature study, described in Chapter 5, in which 35 articles about the implementation of a new form of ICT were analysed. Based on the literature study it was found that almost all authors of the analysed papers recognised that their organisation is influenced by environmental pressures and most of the persons involved in using new forms of ICT are from inside the organisation. Using new forms of ICT in education is in general consistent with the existing goals of the organisation and the implementation is in general voluntary. While almost half of the organisations feel that they are part of an environment that is uncertain, the others assume organisational stability. The results suggested that the implementation of new forms of ICT is not (yet) integrated in the present teaching and learning practice. The ICT factors of major influence on the decision to use new forms of ICT were the push to use new technology and the emerging possibilities of the technology,

new teaching models, the availability of the technology and facilities, new conceptions of learning, a focus on learner/learning and educational and technical support.

Based on the literature study and the dimensions associated with organisational change questions 1 and 5, four possible profiles of universities that are involved in a change process related to using a new form of ICT were constructed by constructing a cross-tab analysis of the bipolar values for the cause and the context of the change dimensions. This resulted in Figure 1.

Context Cause	Uncertain	Interconnected
Social	Profile 1: Supporting learners in a changing world	Profile 2: Developing expertise in the institution
Economic	Profile 3: Surviving in a competitive world	Profile 4: evolving to a cost-effective approach in education

Figure 1 The four profiles

The profiles were further examined in Chapters 6, 7 and 8. Chapter 6 gives an introduction into the chosen methodology for on-site case studies and described the design and the results of a test case study at the George Washington University (Washington D.C., USA). The results from this test case study were used to discuss the research questions and also to give recommendations for the design of subsequent case studies at four universities within the EUNITE (European University Network for Information Technology in Education) network. These case studies, carried out at the University of Twente (the Netherlands), the K.U. Leuven (Belgium), the Helsinki University of Technology (Finland) and Lund University (Sweden), are described in Chapter 7. The results of the four separate case studies are summarised there.

It was concluded in Chapter 7 that the respondents at all four universities have primarily social reasons to use a (new) form of ICT in education, for instance related to the idea that with the support of ICT applications the quality of education can be enhanced and that the support of the learning process of the students can be improved. The economic reasons that were mentioned in the results of the study at the four universities were primarily related to using new forms of ICT to attract more students.

There is not much difference between the universities in relation to the constituents of the change; the majority of the respondents at the four universities indicated that internal involvement has been the major push to use new forms of ICT. With regard to the question about the content of the change there are some differences at the four universities. The majority of the respondents at the UT and the KUL indicated that there has been a change in the way education is supported and delivered since the implementation of new forms of ICT. The respondents at the HUT indicate the opposite and the respondents at the LU are divided in two almost equal groups. With regard to the question about the context of the change there are also differences between the universities. The respondents of the UT perceive the context of the university as uncertain. This is related to diminishing student

numbers and funding and to reorganisation of parts of the university. Half of the respondents from the KUL and the HUT perceive their environment as reasonably stable, the other half sees some uncertainties, again related to diminishing numbers of students and funding. The majority of the respondents at the LU perceive their environment as stable or certain. From these results it was concluded that the UT and the HUT have the majority of the respondents in Profile 1 (Supporting learners in a changing world) and the majority of the respondents from the KUL and the LU are associated with Profile 2 (Developing expertise in the institution).

The most interesting conclusion of Chapter 7 relates to the control of the change or the question whether the new forms of ICT have been implemented voluntarily or under coercion. The UT is the only university in this study for which it can be stated that coercion or enforcement to use new forms of ICT in education has been perceived by the majority of the respondents. At the other universities the number of respondents that indicated coercion is minimal. The relation between these results related to the control of the change and related to the level of implementation brings some extra interesting findings. It was observed that all universities make heavy use of combinations of ICT applications, often including the use of an electronic learning environment, but this seems to be particularly true for the UT (with the electronic learning environment TeleTOP) and the LU (with the electronic learning environment LUVIT). Another observation that was made is that the respondents of the University of Twente perceive the implementation scale of ICT at a high level: over 40% of the respondents indicate that ICT has been integrated in teaching and learning. To a certain extent this is also true for Lund University, although only 10% of the respondents perceive ICT as integrated in the teaching and learning process. The K.U. Leuven and the Helsinki University of Technology tended more towards a combination of increasing awareness of the possibilities of new forms of ICT at all levels and coordinated and supported activities for the implementation of these new forms. From this it could be concluded that the higher the level of coercion or enforcement to use new forms of ICT in education the higher the level or scale of implementation.

Chapter 8 described the results of the cross-site analysis of the case studies in the EUNITE network. The data of the four individual case studies were combined into one set of data and several analyses were carried out. In the previous chapters the four profiles were used to associate universities with specific characteristics, but with the number of respondents in this combined data set (n=88) it was possible to use more advanced statistics to identify underlying common patterns in the data in terms of nine new components. These components are:

1. The new marketplace
2. The pedagogy of flexible learning
3. The technology for flexible learning
4. Students in a dynamic world
5. Concrete vision
6. Workplace demands for ICT in education
7. Individualisation
8. Cost-effectiveness
9. Funding for support

Several methods of statistical analysis were used to compare the following group means in relation to the nine components: (a) group means of the four universities, (b) group means of the old and the new universities, (c) group means of the Nordic and the Dutch-Flemish universities and (d) group means of the roles of the respondents (policy, support and education).

The analysis of the group means of the four universities resulted in significant ($p < 0.5$) differences in group means on Components 3, 5 and 6. The analysis of the group means of the old and new universities resulted in a significant difference in group means on Component 3. The analysis of the group means of the Nordic and the Dutch-Flemish universities resulted in significant differences in group means on Component 6 and the analysis of the group means of the three groups of respondents resulted in significant differences in group means on Component 4. Combining these results with the level of implementation at the different (groups of) universities it was concluded that the new universities and the Dutch-Flemish universities have a higher level of implementation of several new forms of ICT in education. The combination of new universities and Dutch-Flemish universities resulted in the conclusion that it is primarily the University of Twente that has reached higher levels of implementation, especially related to a combination of ICT applications and the electronic learning environment TeleTOP. This confirmed the findings of Chapter 7.

Chapter 9 described conclusions related to organisational change and to new forms of ICT in education. The outcomes related to organisational change resulted in several conclusions, summarised here. Social motives are the prime incentive to use new forms of ICT in education. Instructors from the respondent group education expect more economic benefits from the use of new forms of ICT in education than policy makers. The persons that steer the implementation of new forms of ICT in education come from within the university. These persons are the pioneers and the decision makers and have influence in different stages of the change process. The pioneers influence primarily the initiation stage. If the organisation wants a faculty- or university-wide implementation, it is important that the decision makers make the decision to implement the new form(s) of ICT in education. The decision makers are also the right persons to influence the institutionalisation stage, for instance by policy and/or offering resources. New forms of ICT can bring a change in the way education is offered and supported, but this has not manifested itself on a large scale thus far. Instructors need time, support and sufficient resources to use new forms of ICT appropriate in education. This relates to the importance of the availability of facilities and support described in the next section. From the results of the four case studies it appeared that it is not customary for universities to enforce the decision to implement ICT at a large scale in the university. But in the event that enforcement is applied a higher level of integration of ICT in the teaching and learning process may well be achieved. Even though the respondents indicated specific ICT-related environmental pressures to use new forms of ICT in education, the perception of the respondents about the general context of the university does not seem to have a direct influence on the use of new forms of ICT in education.

The results of the analysis related to new forms of ICT in education resulted in the conclusion that a combination of ICT applications (also including an electronic learning environment) is the overall form of ICT that is most used and supported at the universities.

It was observed that all universities make heavy use of combinations of ICT applications, in two cases, at the UT and the LU, this includes a widespread use of an electronic learning environment. The KUL and the HUT also make use of combinations of ICT applications, but the number of respondents that use an electronic learning environment is very small. From the results of the case studies it was concluded that almost 60% of the respondents of the UT have indicated that there are at least coordinated and supported activities for ICT implementation and that 40% of the respondents state that ICT has been integrated in the teaching and learning processes. The other universities do not indicate that they have this scale of implementation. Furthermore it was concluded that the two universities with a higher level of implementation put more emphasis on support facilities and the two universities with a lower level of implementation are more influenced by environmental pressures.

An important conclusion made in this dissertation is that from the results of the case studies it can be said that the amount of coercion or enforcement has an effect on the choice for a specific new form of ICT in education and on the level of implementation of this form of ICT. It was observed that the respondents of the University of Twente perceived a high level of enforcement to use the electronic learning environment TeleTOP and the results of the case study showed that there is a high level of implementation of this environment (from coordinated and supported activities to implement TeleTOP to TeleTOP integrated in the teaching and learning process).
This dissertation closes with putting the findings of this study into practice by describing a seven-step plan for an ICT coordinator at a university who is responsible for implementing a university-wide electronic learning environment. The seven steps are formulated as (a) establish the motives, (b) determine the target, (c) identify the stars, (d) exert pressure, (e) offer resources, (f) take a step back and (g) evaluate and revise. Following these steps during the process of implementing a new form of ICT in education, the ICT coordinator is better prepared to stimulate the change process that is needed to achieve new ways of ICT-supported teaching and learning.

Samenvatting

De omgeving van universiteiten is onderhevig aan constante veranderingen. Deze veranderingen hebben onder andere te maken met overheid- en beleidgerelateerde aspecten, verwachtingen uit de markt, demografische veranderingen, internationalisering en globalisering en daarbij de groeiende bewustwording dat informatie- en communicatie-technologie (ICT) een bijdrage levert aan het inspelen op deze veranderingen. Gebaseerd op deze ideeën is de volgende onderzoeksvraag voor dit onderzoek geformuleerd:

"(a) Welke factoren hebben een effect op veranderingsprocessen in universiteiten met betrekking tot het implementeren van een nieuwe vorm van ICT in het onderwijs en (b) welk effect heeft de keuze voor deze vorm van ICT op de implementatie ervan in het onderwijs van de faculteiten?"

Het gebruik van "nieuwe vormen van ICT in het onderwijs" is gedefinieerd als het gebruik van verschillende soorten informatie- en communicatietechnologieën die ervoor zorgen dat mensen en middelen contact met elkaar kunnen maken zodat het onderwijs- en leerproces ondersteund kan worden. Deze definitie limiteert ICT niet tot Web-gebaseerde of netwerktechnologieën. ICT kan het World Wide Web en e-mail omvatten, maar ook andere toepassingen zoals videoconferencing en computer ondersteund onderwijs (COO). Met deze brede definitie is het mogelijk om factoren te identificeren die een invloed kunnen hebben op het gebruik van al deze technologieën.

De veranderingen in de omgeving van een universiteit zijn beschreven in Hoofdstuk 1, waarin aangegeven wordt dat ICT gezien wordt als een belangrijk middel om in te spelen op de veranderingen, trends en belanghebbenden. Hieraan gerelateerd wordt gesteld dat het gebruik van nieuwe vormen van ICT een veranderingsproces is. Een verandering, beschreven als een stap in de tijd waarin iets van aanzienlijk belang in de procedures van een organisatie verandert, omvat drie fases: initiatie, implementatie en institutionalisering. Het is zeer waarschijnlijk dat nieuwe vormen van ICT niet altijd de fase van institutionalisering zullen bereiken. Daarom is er een extra indeling voor vormen van implementatie gedefinieerd: (a) incidenteel gebruik van ICT door een of meerdere docenten, (b) een groeiend bewustzijn van de relevantie van ICT op meerdere niveaus in de organisatie, (c) gecoördineerde en ondersteunde activiteiten ten behoeve van de implementatie en (d) ICT geïntegreerd in onderwijs en leren. Daarnaast wordt aangenomen dat in zowel de beslissing om een nieuwe vorm van ICT te gaan gebruiken en in het proces van implementatie van deze nieuwe vorm van ICT een veranderingsproces nodig is.

Veranderingsprocessen zijn niet uniek voor universiteiten of voor het implementeren van nieuwe vormen van ICT in het onderwijs. Hoofdstuk 2 beschrijft twee organisatieveranderingstheorieën, Institutional Theory en Resource Dependency Theory, die de basis voor dit onderzoek vormen. Binnen de Institutional Theory worden organisaties gezien als groepen mensen die gestandaardiseerde pakketen van regels, procedures en opvattingen representeren. Het handhaven van legitimiteit van de organisatie naar buiten toe draagt bij aan de overleving van de organisatie. Binnen de Resource Dependency Theory worden organisaties beschreven als flexibel, waarbij de taakomgeving, de sociale omgeving

en de invloed van overheden een effect hebben op veranderingen in de organisatie. Een belangrijk gegeven binnen deze theorie is dat, onafhankelijk van andere doelen, alle acties van de organisatie gericht zijn op overleving. Om dit te bereiken moet de organisatie een bepaalde mate van controle hebben over de middelen die beschikbaar zijn.

Ondanks de verschillende opvattingen van de twee theorieën is het mogelijk om een aantal overeenkomstige en afwijkende aspecten te identificeren. Institutional Theory en Resource Dependency Theory delen de assumpties dat keuzes en acties van een organisatie beïnvloed worden door externe impulsen en dat een organisatie gericht moet zijn op overleving. De twee theorieën verschillen in opvatting over de mate van het vermogen om te reageren op veranderingen uit de omgeving en over de manier van reageren op deze veranderingen.

Om te bepalen welke positie een organisatie inneemt met betrekking tot deze overeenkomstige en afwijkende aspecten werden door Oliver (1991) vijf vragen geformuleerd. Deze vragen weren aangepast voor het onderzoek in dit proefschrift:

1. Voelt de universiteit zich onder druk gezet om nieuwe vormen van ICT in het onderwijs te gebruiken en zo ja, waarom? (antwoorddimensie: de reden voor de verandering)
   - antwoordwaarde 1: sociale motieven
   - antwoordwaarde 2: economische motieven

2. Wie voert invloed uit op de beslissing om nieuwe vormen van ICT in het onderwijs te gebruiken? (antwoorddimensie: de betrokkenen bij de verandering)
   - antwoordwaarde 1: externe betrokkenen
   - antwoordwaarde 2: interne betrokkenen

3. Op basis van welke eisen met betrekking tot nieuwe vormen van ICT is de verandering doorgevoerd? (antwoorddimensie: de inhoud van de verandering)
   - antwoordwaarde 1: consistentie met de bestaande praktijk
   - antwoordwaarde 2: veranderingen ten opzichte van de bestaande praktijk

4. Hoe is de verandering met betrekking tot de implementatie van nieuwe vormen van ICT doorgevoerd? (antwoorddimensie: de controle op de verandering)
   - antwoordwaarde 1: onder dwang
   - antwoordwaarde 2: vrijwillig

5. Wat karakteriseert de context van de universiteit? (antwoorddimensie: de context van de verandering)
   - antwoordwaarde 1: onzekerheid
   - antwoordwaarde 2: stabiliteit

Deze vijf ‘organisational change’-vragen (OC-vragen) en de antwoorddimensies met antwoordwaarden vormen de basis voor dit onderzoek. De antwoorden op deze vragen kunnen worden gezocht op basis van informatie die beschikbaar is over nieuwe vormen van ICT in het onderwijs. Hoofdstuk 3 beschrijft daartoe factoren die van invloed kunnen zijn op de beslissing om nieuwe vormen van ICT te gebruiken. Deze factoren zijn ondergebracht in zes categorieën: (a) druk vanuit de omgeving, (b) technologische ontwikkelingen, (c) onderwijskundige ontwikkelingen, (d) het profiel van de instelling, (e) kosten overwegingen

en (f) beschikbaarheid van ondersteuning. De complete lijst met factoren is gepresenteerd in Tabel 1 (eerder gepresenteerd in deze dissertatie in Hoofstuk 3, Tabel 7).

Tabel 1 Factoren die invloed hebben op het gebruik van ICT in het onderwijs

Categorie	Factoren	
Druk vanuit de omgeving	Nieuwe doelgroepen	Concurrentie
	Bedrijfstraining	Inspelen op dreigingen en kansen
	Parttime studenten	Flexibiliteit
	Lifelong learning	Kennismanagement
	On-demand training	Verandering in student
	Subsidies	demografie
	Samenwerking	Eisen van de werkgevers
	Tailor-made products	Eisen van de studenten
	Dynamische omgeving	
Technologische ontwikkelingen	Nieuwe mogelijkheden	Nieuwe technologie (push, hype)
	Afhankelijkheid van technologie	
Onderwijskundige ontwikkelingen	Nieuwe concepten over leren	Inspelen op individuele verschillen
	Nieuwe doceermodellen	Actief leren
	Focus op student / leren/	
Profiel van de instelling	Brede participatie	Verbeterde toegang tot onderwijs
	Gedeelde visie	Leiderschap
	Concrete plannen	
Kosten overwegingen	Verminderen van de kosten	Opbrengsten (geld, motivatie,
	Kosten-effectiviteit	etc.)
Beschikbaarheid van ondersteuning	Ondersteuning van het management	Beschikbaarheid techniek
		Beschikbaarheid faciliteiten
	Technische en onderwijskundige ondersteuning	

In Hoofdstuk 4 worden de organisatieveranderingstheorieën gecombineerd met de ICT factoren zoals gepresenteerd in Tabel 1 en wordt deze combinatie gerelateerd aan de onderzoeksvragen. Om de onderzoeksvragen te analyseren wordt vervolgens een case studie strategie gevolgd. De eerste case studie, beschreven in Hoofdstuk 5, is een literatuur studie waarin 35 artikelen over de implementatie van nieuwe vormen van ICT in het onderwijs worden geanalyseerd. De resultaten van deze analyse wijzen erop dat bijna alle auteurs van de artikelen aangeven dat de organisatie waarin ICT is geïmplementeerd beïnvloed zijn door druk vanuit de omgeving. Daarnaast komt naar voren dat de personen die betrokken zijn bij de implementatie in de meeste gevallen vanuit de organisatie zelf komen. Het onderwijs waarin gebruik gemaakt wordt van nieuwe vormen van ICT is meestal consistent met hoe het onderwijs vóór de implementatie vormgegeven was, waarbij de implementatie zelf over het algemeen vrijwillig is gegaan. In ongeveer de helft van de artikelen wordt aangegeven dat de omgeving van de universiteit onzeker is, de andere helft geeft aan dat er een zekere mate van stabiliteit is. De resultaten van de literatuur studie suggereren dat de nieuwe vormen van ICT (nog) niet geïntegreerd zijn in het onderwijs. De ICT factoren die van groot belang lijken te zijn op de beslissing om nieuwe vormen van ICT te gaan gebruiken zijn gerelateerd aan technologische ontwikkelingen, onderwijskundige

ontwikkelingen (met name nieuwe doceermodellen, nieuwe concepten over leren en een focus op de student) en de beschikbaarheid van ondersteuning.
Op basis van de literatuurstudie en de OC-vragen 1 en 5 zijn vier mogelijke profielen van universiteiten die bezig zijn met de implementatie van nieuwe vormen van ICT in het onderwijs samengesteld, gepresenteerd in Figuur 1 (eerder gepresenteerd in deze dissertatie in Hoofstuk 5, Figuur 4).

Reden \ Context	Onzeker	Stabiel
Sociaal	**Profiel 1: Ondersteunen van studenten in een veranderende wereld**	**Profiel 2: Ontwikkelen van expertise in de instelling**
Economisch	**Profiel 3: Overleven in een concurrerende wereld**	**Profiel 4: Ontwikkelen van een kosten-effectieve aanpak in onderwijs**

Figuur 10 Vier profielen van redenen voor ICT gebruik

De vier profielen worden verder onderzocht in de Hoofdstukken 6, 7 en 8. Hoofdstuk 6 beschrijft de gekozen methodologie voor het doen van case studies bij de verschillende universiteiten en het ontwerp en de resultaten van een test case studie op de George Washington University (Washington D.C., VS). De resultaten van deze case studie zijn gebruikt om een antwoord te geven op de onderzoeksvragen en om aanbevelingen te doen voor de daaropvolgende case studies bij vier universiteiten in het EUNITE (European University Network for Information Technology in Education) netwerk. Deze vier case studies, uitgevoerd bij de Universiteit Twente (UT, Nederland), de Katholieke Universiteit Leuven (KUL, België), de Helsinki University of Technology (HUT, Finland) en Lund University (LU, Zweden), zijn beschreven in Hoofdstuk 7.

Uit de resultaten van Hoofdstuk 7 kan geconcludeerd worden dat de respondenten van alle vier de universiteiten met name sociale motieven hebben om nieuwe vormen van ICT in het onderwijs te gebruiken. Deze motieven omvatten onder andere het idee dat met behulp van ICT toepassingen het leerproces van studenten beter ondersteund kan worden en dat de kwaliteit van het onderwijs verbetert kan worden. De economische motieven die genoemd werden door de respondenten waren met name gerelateerd aan het aantrekken van nieuwe studenten en nieuwe doelgroepen van studenten.

Er is niet veel verschil tussen de universiteiten wat betreft de betrokkenen bij de verandering. De meerderheid van de respondenten geeft aan dat betrokkenen van binnen de organisatie de grootste invloed hebben op het gebruik van nieuwe vormen van ICT in het onderwijs. Met betrekking tot de inhoud van de veranderingen zijn verschillen geconstateerd. De meerderheid van de respondenten van de UT en de KUL geven aan dat er een verandering is opgetreden in de manier van onderwijs geven en ondersteunen sinds de implementatie van ICT toepassingen. De respondenten van de HUT daarentegen geven het tegenovergestelde aan en de respondenten van LU zijn verdeeld op dit punt in twee bijna gelijke groepen. Met betrekking tot de vraag over de context van de verandering kan geconcludeerd worden dat met name de respondenten van de UT de omgeving van de universiteit als onzeker zien. Daarbij gaat het met name om het verminderd aantal studenten en subsidies en toekomstige reorganisaties. Bij de KUL en de HUT ziet ongeveer de helft

van de respondenten de omgeving van de universiteit als onzeker (ook hier gerelateerd aan verminderd aantal studenten en subsidies). De meerderheid van de respondenten van LU ziet de omgeving van hun universiteit als stabiel. Uit deze resultaten werd geconcludeerd dat de UT en de HUT met name geassocieerd worden met profiel 1 (Ondersteunen van studenten in een veranderende wereld) en de KUL en LU met profiel 2 (Ontwikkelen van expertise in de instelling).

De meest opvallende conclusie uit Hoofdstuk 7 heeft te maken met de vraag naar de controle op de verandering. Uit de resultaten blijkt dat de UT de enige universiteit is waarover gezegd kan worden dat er een bepaalde druk is uitgevoerd om nieuwe vormen van ICT in het onderwijs te gaan gebruiken. Als dit gerelateerd wordt aan de mate van implementatie blijkt dat alle universiteiten gebruik maken van een combinatie aan ICT toepassingen, inclusief elektronische leeromgevingen, maar dat met name op de UT de mate van implementatie als zeer hoog wordt ingeschat: meer dan 40% van de respondenten geeft aan dat ICT geïntegreerd is in het reguliere onderwijs- en leerproces. Hierbij gaat het voornamelijk over het gebruik van de elektronische leeromgeving TeleTOP. Tot op zekere hoogte zijn deze resultaten ook bij LU te vinden in relatie tot de elektronische leeromgeving LUVIT, maar hier geeft slechts 10% van de respondenten aan dat ICT geïntegreerd is in het onderwijs. De KUL en de HUT neigen meer naar een combinatie van groeiend bewustzijn van de mogelijkheden van ICT en gecoördineerde en ondersteunde activiteiten voor de implementatie van ICT. Hieruit werd geconcludeerd dat hoe hoger de mate van controle en druk op de implementatie, hoe hoger de mate van implementatie en integratie van ICT in het onderwijs.

Hoofdstuk 8 beschrijft de resultaten van de cross-site analyse van de EUNITE case studie. De data van de vier individuele case studies werden gecombineerd tot één databestand en verschillende analyses werden uitgevoerd. Met een totaal aantal respondenten van 88 was het mogelijk om met meer geavanceerde statistische technieken negen beschrijvende factoren (of componenten) te ontwikkelen. Deze componenten zijn:

1. De nieuwe markt
2. De pedagogiek van flexibel leren
3. De techniek voor flexibel leren
4. Studenten in een dynamische wereld
5. Concrete visie op ICT in het onderwijs
6. Eisen vanuit de werkplek
7. Individualisering
8. Kosten-effectiviteit
9. Subsidies voor ondersteuning

Statistische methoden werden gebruikt om verschillende groepen met elkaar te vergelijken: (a) de vier universiteiten, (b) oude en nieuwe universiteiten (KUL en LU versus UT en HUT), (c) noordelijke en Nederlands-Belgische universiteiten (HUT en LU versus UT en KUL) en (d) rollen van respondenten (beleid, ondersteuning, onderwijs).

De analyse van deze vergelijkingen resulteerde in significante ($p < 0.5$) verschillen voor componenten 3, 5 en 6 tussen de vier universiteiten. Voor de oude en nieuwe universiteiten werd een significant verschil gevonden voor component 3 en voor de noordelijke en

Nederlands-Belgische universiteiten werd een significant verschil gevonden voor Component 4. Er werd geen significant verschil gevonden in relatie tot de rollen van de respondenten. Een combinatie van deze resultaten met het niveau van implementatie van nieuwe vormen van ICT in het onderwijs op de verschillende universiteiten leidt tot de conclusie dat nieuwe en Nederlands-Belgische universiteiten een hogere mate van implementatie en integratie van ICT in het onderwijs hebben bereikt. Daaruit blijkt dat het hierbij met name om de UT gaat met het gebruik van verschillende ICT toepassingen en de TeleTOP omgeving. Dit bevestigd de resultaten van Hoofdstuk 7.

Hoofdstuk 9 beschrijft de conclusies van dit onderzoek over organisatie veranderingen en het gebruik van nieuwe vormen van ICT in het onderwijs. De uitkomsten met betrekking tot organisatie veranderingen resulteerde in een aantal conclusies, hier samengevat. Er zijn met name sociale motieven voor de beslissing om nieuwe vormen van ICT in het onderwijs te gaan gebruiken. Wel werd geconstateerd dat docenten meer economisch profijt verwachten door het gebruik van ICT in vergelijking met ondersteuners en beleidsmakers. De personen die de beslissing om ICT te gaan gebruiken stimuleren zijn met name personen van binnen de eigen universiteit. Daarbij zijn zowel de pioniers als de beslissers van belang. De pioniers zijn met name in de initiatie fase van groot belang, de beslissers (management) zijn nodig als de universiteit besluit om een universiteit- of faculteitbrede implementatie te starten. De beslissers zijn ook degene die de fase van institutionalisering kunnen beïnvloeden, bijvoorbeeld door het maken van beleid of door het aanbieden van middelen.

Nieuwe vormen van ICT kunnen een verandering teweeg brengen in de manier waarop het onderwijs gegeven en ondersteund wordt, maar dit gebeurt (nog) niet op grote schaal. Docenten hebben tijd, ondersteuning en voldoende middelen nodig om ICT op een goede manier in het onderwijs te integreren. De omgeving van de universiteit schijnt niet een direct invloed te hebben op het gebruik van ICT in het onderwijs. Uit de resultaten van de case studies blijkt verder dat universiteiten niet gewend zijn om druk uit te oefenen om de implementatie van ICT door te voeren. In het geval dat deze druk wel uitgeoefend wordt blijkt dat er een grotere mate van implementatie en integratie van ICT in het onderwijs gezien wordt.

Uit de resultaten van de analyses met betrekking tot het gebruik van nieuwe vormen van ICT in het onderwijs werd geconcludeerd dat een combinatie van ICT toepassingen (inclusief een elektronische leeromgeving) de vorm van ICT is die het meest gebruikt en ondersteund wordt op de universiteiten. Ongeveer 60% van de respondenten van de UT geeft aan dat er tenminste gecoördineerde en ondersteunde activiteiten zijn voor de implementatie van ICT, 40% geeft aan dat ICT geïntegreerd is in het onderwijs. Op de andere drie universiteiten is de mate van implementatie lager. Verder blijkt dat universiteiten die nog niet een hoog niveau van implementatie en integratie hebben bereikt met name beïnvloed worden door onderwijskundige redenen om ICT in het onderwijs te gaan gebruiken. Op het moment dat ICT op een gecoördineerde manier geïmplementeerd en geïntegreerd wordt in het onderwijs worden de ondersteunende faciliteiten belangrijker. Uit bovenstaande resultaten en conclusies kan worden afgeleid dat een bepaalde mate van druk of dwang een positief effect heeft op de mate van implementatie en integratie van nieuwe vormen van ICT in het onderwijs. Dit blijkt met name uit de resultaten van de Universiteit Twente, waar de elektronische leeromgeving TeleTOP ingevoerd werd.

Deze dissertatie wordt afgesloten met het in praktijk brengen van de resultaten van dit onderzoek door het beschrijven van een zeven stappen plan voor een ICT coördinator die verantwoordelijk is voor het invoeren van universiteitbrede elektronische leeromgeving. De zeven stappen zijn geformuleerd als (a) stel de motieven vast, (b) bepaal het doel, (c) identificeer de innovatoren, (d) oefen druk uit, (e) biedt hulpmiddelen aan, (f) neem een stap terug en (g) evalueer en herzie. Met behulp van deze stappen is de ICT coördinator beter voorbereid op het proces van de implementatie van een nieuwe vorm van ICT in het onderwijs, de elektronische leeromgeving. Op die manier kan de coördinator het veranderingsproces dat nodig is om de implementatie en integratie van de leeromgeving te bereiken stimuleren.

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Appendix A: Complete list of papers used for the literature study

From: Collis, B., & Ring, J. (Eds.). (1999). Scaling up: Faculty change and the WWW [Special Double Issue] *Interactive Learning Environments, 7*(2/3).

1. Anderl, R., & Vogel, V., Teaching environment for the education of engineering students, 195-208.
2. Bottomley, J., Spratt, C., & Rice, M., Strategies for effecting strategic organisational change in teaching practices: Case studies at Deakin University, 227-247.
3. Chalmers, D., A Strategic University-Wide Initiative to Introduce Programs of Study Using Flexible Delivery Methods, 249-268.
4. Collis, B., & De Boer, W., Scaling up from the pioneers: The TeleTOP Method at the University of Twente, 093-111.
5. Deek, F., Deek, M., & Friedman, R., The virtual classroom experience: Viewpoints from computing and humanities, 113-136.
6. Fox, M., & Helford, P., Advancing the boundaries of higher education in Arizona using the World Wide Web, 155-174.
7. Hunt, N., PROJECT LEARN: Supporting on-campus learning with on-line technologies, 269-282.
8. Littlejohn, A., & Sclater, N., The virtual university as a conceptual model for faculty change and innovation, 209-225.
9. Sorg, S., Truman-Davis, B., Dziuban, C., Moskal, P., Hartman, J., & Juge, F., Faculty development, learner support and evaluation in Web-based programs, 137-154.
10. Tomek, I., & Müldner, T., Acadia advantage - Evolution and experiences, 175-194.
11. Wende, M. van der Beerkens, E., An international orientation on institutional strategies and governmental policies for the use of ICT in higher education, 283-321.

From: Davies, G. (Ed.) (1998). *Teleteaching '98. Distance learning, training and education*: *Proceedings of the XV IFIP World Computer Congress*. Vienna: Austrian Computer Society.

12. Adelsberger, H.H., Körner, F.X., & Pawlowski, J.M., A conceptual model for an integrated design of computer supported learning environments and workflow management systems, 55-64.
13. Antonsen, S.G., User-adapted education for adults – Trønderverkstedet, 65-72.
14. Arnaud, M., Study on pedagogical impacts of Internet and perverse effects of virtual universities in CNED knowledge centers for open and distance learning, 73-84.
15. Baaberg, B., Internet based delivery systems for distance learning, 95-98.
16. Bharat, D., Global architectural design studios, 119-128.
17. Blignaut, R.J., Venter, I.M., & Stoltz, D., Chalk-and-talk versus cooperative learning: A comparative study, 139-148.
18. Bottino, R,M., & Chiappini, G., Teachers training: New models and tools in the era of communication technologies, 149-158.

19. Campbell, N., Yates, R., & McGee, C., Bridging education in the classroom and distance education: The development new forms of teacher education delivery, 169-178.
20. Campo-Montalvo, E., Martinez-Orga, V., Medinilla-Martinez, N., & Meziat-Luna, D., Internet support for collaborative learning in workgroups, 179-188.
21. Collis, B., & Fisser, P., TeleTOP, telelearning at the University of Twente, 217-228.
22. Dicehva, D., Djakova, I., & Bachvarova, Y., Building and using a business English virtual classroom: Lessons l earned, 271-280.
23. Gjendem, J.T., NTNUs model for distance education based on collaborative learning, 333-348.

From: Banks, S., Graebner, C., & McConnell, D. (Eds.). (1998). *Networked lifelong learning: Innovative approaches to education and training through the Internet*. Sheffield, UK: University of Sheffield.

24. Banks, B., Supporting networked learning as a whole: Pedagogy, management and the learning environment, 1.1-1.7.
25. Garcia, M., & Maia, C., Act On Line Project: Networked learning practice on Internet/WWW, 2.15-2.20.
26. Graebner, C., Learning community on-line: Developing shared spaces in the academic context, 1.63-1.71.
27. Holtham, C., & Tiwari, A., Physical universities can apply virtual technologies too: The use of networked technologies to support collaborative learning, 2.25-2.32.
28. Huysman, M., & Gerrits, H., The dynamics of Internet supported team learning: A case study, 2.33-2.46.
29. Jones, A., Making lifelong learning real: Reaching people the system doesn't usually reach, 4.7-4.12.
30. McGoldrick, T., Shelley, V., & Cummins, P., Stockton-on-Lne (SoL) – A case study, 4.13-4.18.
31. Oliver, D., Luck, J., & Vieth, E., Chalk to cable (Conquering the tyranny of distance in Australian higher education), 4.59-4.66
32. Procter, P.M., The tutorial: Combining asynchronous and synchronous learning, 3.1-3.7.
33. Rimmershaw, R., Supporting a culture of collaborative study: Collaborative study in undergraduate courses using a computer-based conferencing system, 1.48-1.54.
34. Toynton, R., The interactive website as a medium for teaching and learning: A case study in presenting introductory science, 1.33-1.41.
35. Ward, H., Tracey, K., & Barker, M., Developing a virtual college, 4.43-4.51.

Appendix B: Scoring form A of the literature study

Indication of the number of papers/articles that can be associated with dimensions on the five organisational change questions and an indication of which categories of ICT factors had an influence on the dimension.

Articles 1-5

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 1	Paper 2	Paper 3	Paper 4	Paper 5	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 1	Paper 2	Paper 3	Paper 4	Paper 5
Cause	Legitimacy or social fitness *and/or*	**X**			**X**	**X**	Environmental pressures	X	X	X	X	X
							Technology developments					
							Educational developments			X		
	Efficiency or economic fitness		**X**	**X**	**X**	**X**	Institutional conditions			X	X	X
							Costs			X		
							Support					
Constituents	Multiplicity of constituent demands *and/or*						Environmental pressures	X				
							Technology developments					
							Educational developments					X
	Dependence on institutional constituents	**X**	**X**	**X**	**X**	**X**	Institutional conditions	X	X	X	X	X
							Costs					
							Support					

Appendix B continues…

Articles 1-5 (continued)

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 1	Paper 2	Paper 3	Paper 4	Paper 5	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 1	Paper 2	Paper 3	Paper 4	Paper 5
Content	Consistency with organisational goals *and/or*	**X**	**X**	**X**	**X**	**X**	Environmental pressures	X				
							Technology developments	X	X	X	X	X
							Educational developments	X	X	X	X	X
	Discretionary constrains imposed on the organisation						Institutional conditions		X	X	X	X
							Costs			X		
							Support	X	X	X	X	
Control	Legal coercion or enforcement *and/or*		**X**	**X**	**X**		Environmental pressures		X			
							Technology developments			X		
							Educational developments			X		
	Voluntary diffusion of norms	**X**				**X**	Institutional conditions	X	X	X	X	X
							Costs		X	X		
							Support				X	X
Context	Environmental uncertainty *and/or*	**X**	**X**		**X**	**X**	Environmental pressures	X	X	X	X	X
							Technology developments	X	X		X	X
							Educational developments		X		X	
	Environmental interconnectedness	**X**		**X**	**X**		Institutional conditions		X	X	X	X
							Costs		X		X	
							Support					

Articles 6-10

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 6	Paper 7	Paper 8	Paper 9	Paper 10	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 6	Paper 7	Paper 8	Paper 9	Paper 10
Cause	Legitimacy or social fitness *and/or*	**X**	**X**				Environmental pressures	X	X	X	X	X
							Technology developments		X	X		
							Educational developments					
	Efficiency or economic fitness			**X**	**X**	**X**	Institutional conditions	X	X		X	
							Costs					
							Support					
Constituents	Multiplicity of constituent demands *and/or*						Environmental pressures					
							Technology developments					
							Educational developments		X			
	Dependence on institutional constituents	**X**	**X**	**X**	**X**	**X**	Institutional conditions	X	X	X	X	X
							Costs	X				
							Support	X				

Appendix B continues…

Articles 6-10 (continued)

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 6	Paper 7	Paper 8	Paper 9	Paper 10	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 6	Paper 7	Paper 8	Paper 9	Paper 10
Content	Consistency with organisational goals *and/or*	**X**	**X**	**X**	**X**	**X**	Environmental pressures					
							Technology developments		X	X	X	X
							Educational developments	X	X	X	X	X
	Discretionary constrains imposed on the organisation						Institutional conditions	X		X	X	
							Costs			X		
							Support	X	X	X	X	
Control	Legal coercion or enforcement *and/or*					**X**	Environmental pressures					
							Technology developments					
							Educational developments		X			
	Voluntary diffusion of norms	**X**	**X**	**X**	**X**		Institutional conditions	X	X	X	X	X
							Costs	X	X			X
							Support			X	X	
Context	Environmental uncertainty *and/or*	**X**	**-**	**X**	**X**		Environmental pressures	X	X	X	X	X
							Technology developments	X	X	X	X	X
							Educational developments					
	Environmental interconnectedness		**-**			**X**	Institutional conditions		X		X	X
							Costs	X	X	X		X
							Support					X

Articles 11-15

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 11	Paper 12	Paper 13	Paper 14	Paper 15	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 11	Paper 12	Paper 13	Paper 14	Paper 15
Cause	Legitimacy or social fitness *and/or*	**X**		**X**	**X**	**X**	Environmental pressures	X	X	X	X	X
							Technology developments	X	X			X
							Educational developments			X	X	
	Efficiency or economic fitness	**X**	**X**			**X**	Institutional conditions	X	X			X
							Costs	X				
							Support					
Constituents	Multiplicity of constituent demands *and/or*			**X**			Environmental pressures	X		X		X
							Technology developments					
							Educational developments					
	Dependence on institutional constituents	**X**	**X**		**X**	**X**	Institutional conditions	X		X	X	X
							Costs	X				
							Support	X		X		X

Appendix B continues…

Articles 11-15 (continued)

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 11	Paper 12	Paper 13	Paper 14	Paper 15	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 11	Paper 12	Paper 13	Paper 14	Paper 15
Content	Consistency with organisational goals *and/or*	**X**	**X**		**X**	**X**	Environmental pressures					
							Technology developments	X	X	X	X	X
							Educational developments	X	X	X	X	X
	Discretionary constrains imposed on the organisation			**X**			Institutional conditions	X				
							Costs					
							Support				X	X
Control	Legal coercion or enforcement *and/or*		**-**			**X**	Environmental pressures	X				
							Technology developments					
							Educational developments	X			X	
	Voluntary diffusion of norms	**X**	**-**	**X**	**X**		Institutional conditions	X	X			X
							Costs	X				
							Support	X				X
Context	Environmental uncertainty *and/or*	**X**		**X**	**X**	**X**	Environmental pressures	X	X		X	X
							Technology developments	X			X	X
							Educational developments				X	X
	Environmental interconnectedness	**X**	**X**	**X**	**X**		Institutional conditions	X				X
							Costs					
							Support					

Articles 16-20

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 16	Paper 17	Paper 18	Paper 19	Paper 20	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 16	Paper 17	Paper 18	Paper 19	Paper 20
Cause	Legitimacy or social fitness *and/or*	**X**	**X**		**X**	**X**	Environmental pressures		X	X	X	X
							Technology developments	X	X	X	X	
							Educational developments	X				
	Efficiency or economic fitness		**X**	**X**			Institutional conditions					
							Costs					
							Support					
Constituents	Multiplicity of constituent demands *and/or*		**X**				Environmental pressures		X		X	X
							Technology developments					
							Educational developments	X				X
	Dependence on institutional constituents	**X**		**X**	**X**	**X**	Institutional conditions	X	X	X		
							Costs					
							Support				X	

Appendix B continues…

Articles 16-20 (continued)

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 16	Paper 17	Paper 18	Paper 19	Paper 20	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 16	Paper 17	Paper 18	Paper 19	Paper 20
Content	Consistency with organisational goals *and/or*	**X**		**X**		**X**	Environmental pressures					X
							Technology developments	X	X	X	X	
							Educational developments	X	X	X	X	X
	Discretionary constrains imposed on the organisation		**X**		**X**		Institutional conditions					
							Costs			X		
							Support			X	X	X
Control	Legal coercion or enforcement *and/or*		**-**	**X**	**-**	**-**	Environmental pressures		X			
							Technology developments					
							Educational developments	X				
	Voluntary diffusion of norms	**X**	**-**		**-**	**-**	Institutional conditions	X	X	X		
							Costs			X		
							Support					
Context	Environmental uncertainty *and/or*			**X**			Environmental pressures		X	X	X	X
							Technology developments	X	X	X	X	
							Educational developments	X	X			
	Env. interconnectedness	**X**	**X**		**X**	**X**	Institutional conditions	X	X			
							Costs		X	X		
							Support					

Articles 21-25

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 21	Paper 22	Paper 23	Paper 24	Paper 25	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 21	Paper 22	Paper 23	Paper 24	Paper 25
Cause	Legitimacy or social fitness *and/or*	**X**	**X**	**X**	**X**	**X**	Environmental pressures	X	X	X		
							Technology developments	X	X		X	X
							Educational developments	X			X	X
	Efficiency or economic fitness		**X**				Institutional conditions					
							Costs					
							Support					
Constituents	Multiplicity of constituent demands *and/or*		**X**				Environmental pressures	X	X	X		
							Technology developments					
							Educational developments	X	X	X	X	X
	Dependence on institutional constituents	**X**		**X**	**X**	**X**	Institutional conditions					
							Costs					
							Support					

Appendix B continues…

Articles 21-25 (continued)

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 21	Paper 22	Paper 23	Paper 24	Paper 25	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 21	Paper 22	Paper 23	Paper 24	Paper 25
Content	Consistency with organisational goals *and/or*		**X**	**X**	**X**	**X**	Environmental pressures					
							Technology developments					
							Educational developments	X	X	X	X	X
	Discretionary constrains imposed on the organisation	**X**					Institutional conditions					
							Costs					
							Support	X	X			
Control	Legal coercion or enforcement *and/or*	**-**		**-**	**-**		Environmental pressures					
							Technology developments					
							Educational developments					
	Voluntary diffusion of norms	**-**	**X**	**-**	**-**	**X**	Institutional conditions	X	X			
							Costs					
							Support		X			
Context	Environmental uncertainty *and/or*						Environmental pressures	X	X	X		
							Technology developments	X	X	X	X	X
							Educational developments	X	X			
	Environmental interconnectedness	**X**	**X**	**X**	**X**	**X**	Institutional conditions		X			
							Costs					
							Support					

Articles 26-30

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 26	Paper 27	Paper 28	Paper 29	Paper 30	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 26	Paper 27	Paper 28	Paper 29	Paper 30
Cause	Legitimacy or social fitness *and/or*	**X**	**X**	**X**	**X**		Environmental pressures	X	X	X	X	X
							Technology developments	X	X		X	
							Educational developments	X	X	X	X	
	Efficiency or economic fitness					**X**	Institutional conditions					
							Costs					X
							Support					
Constituents	Multiplicity of constituent demands *and/or*	**X**			**X**		Environmental pressures	X				X
							Technology developments					
							Educational developments					
	Dependence on institutional constituents		**X**	**X**		**X**	Institutional conditions	X		X	X	
							Costs					
							Support		X			X

Appendix B continues…

Articles 26-30 (continued)

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 26	Paper 27	Paper 28	Paper 29	Paper 30	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 26	Paper 27	Paper 28	Paper 29	Paper 30
Content	Consistency with organisational goals *and/or*		**X**	**X**	**X**	**X**	Environmental pressures					
							Technology developments		X		X	X
							Educational developments	X	X	X	X	X
	Discretionary constrains imposed on the organisation	**X**					Institutional conditions	X			X	
							Costs					X
							Support					
Control	Legal coercion or enforcement *and/or*		**-**	**-**			Environmental pressures					
							Technology developments					
							Educational developments	X	X	X		
	Voluntary diffusion of norms	**X**	**-**	**-**	**X**	**X**	Institutional conditions			X	X	X
							Costs					
							Support					
Context	Environmental uncertainty *and/or*	**X**		**X**			Environmental pressures	X	X	X	X	X
							Technology developments		X	X		
							Educational developments					
	Environmental interconnectedness		**X**		**X**	**X**	Institutional conditions					
							Costs					X
							Support					

Articles 31-35

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 31	Paper 32	Paper 33	Paper 34	Paper 35	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 31	Paper 32	Paper 33	Paper 34	Paper 35
Cause	Legitimacy or social fitness *and/or*		**X**	**X**			Environmental pressures	X	X	X	X	X
							Technology developments		X	X		
							Educational developments	X	X	X	X	X
	Efficiency or economic fitness	**X**			**X**	**X**	Institutional conditions		X			X
							Costs					X
							Support		X	X		
Constituents	Multiplicity of constituent demands *and/or*	**X**	**X**				Environmental pressures		X		X	
							Technology developments					
							Educational developments					
	Dependence on institutional constituents			**X**	**X**	**X**	Institutional conditions		X		X	X
							Costs					
							Support					

Appendix B continues…

Articles 31-35 (continued)

Organisational change factor	Number of papers of which can be confirmed that they are likely to fit in the following dimensions	Paper 31	Paper 32	Paper 33	Paper 34	Paper 35	Number of papers of which can be confirmed that the universities are likely influenced by the following ICT factors	Paper 31	Paper 32	Paper 33	Paper 34	Paper 35
Content	Consistency with organisational goals *and/or*		**X**	**X**	**X**	**X**	Environmental pressures					
							Technology developments		X	X	X	
							Educational developments	X	X	X	X	X
	Discretionary constrains imposed on the organisation	**X**					Institutional conditions					X
							Costs					X
							Support					
Control	Legal coercion or enforcement *and/or*		**X**			**-**	Environmental pressures				X	
							Technology developments					
							Educational developments		X	X	X	
	Voluntary diffusion of norms	**X**		**X**	**X**	**-**	Institutional conditions			X		X
							Costs					X
							Support		X	X		
Context	Environmental uncertainty *and/or*	**X**			**X**	**X**	Environmental pressures	X	X	X	X	X
							Technology developments			X	X	X
							Educational developments					
	Environmental interconnectedness		**X**	**X**			Institutional conditions				X	X
							Costs					X
							Support					

Appendix C: Scoring form B of the literature study

Specific ICT factors that had an influence on the decision to use new forms of ICT in education

Category of ICT factors	ICT Factors	Score from the papers from the Teleteaching conference (n=12)	Score from the papers from the NLL conference (n=12)	Score from the papers from Interactive Learning Environments (n=11)	Total score of the combined papers (n=35)
Environmental pressures	New market	6	0	5	11
	Business education	0	0	1	1
	Part-time students	1	1	5	7
	Lifelong learning	4	5	5	14
	On-demand training	1	0	1	2
	Funding	2	3	10	15
	Partnerships	4	5	4	13
	Tailor-made products	2	0	0	2
	Dynamic environment	0	0	0	0
	Competition	2	1	4	7
	Response to threats and opportunities	1	0	1	2
	Flexibility	8	8	8	24
	Knowledge management	0	0	0	0
	Changing student demographics	3	4	8	15
	Demands from employers	1	1	3	5
	Demands from learners	4	2	5	11

Appendix C continues...

Appendix C (continued)

Technology developments	Emerging technology	10	5	5	20
	Dependence on IT	2	0	0	2
	New technology (push, hype)	8	12	10	30
Institutional conditions	New organisational structure	3	1	3	7
	Broad participation	3	3	7	13
	Shared vision	1	2	1	4
	Concrete plans	3	1	8	12
	Improved access to education	0	3	7	10
	Leadership	3	0	7	10
Educational developments	New conceptions of learning	7	6	10	23
	New teaching models	9	10	10	29
	Focus on learner/learning	7	8	4	19
	Individual differences	2	1	0	3
	Active learning	4	3	4	11
Cost reduction / Cost-effectiveness	Reducing costs	3	2	5	10
	Cost-effectiveness	2	2	7	11
	Benefits	0	0	2	2
Support facilities	Administrative support	1	0	8	9
	Educational and technical support	4	3	11	18
	Availability technology	8	8	11	27
	Availability facilities	9	6	11	26

Appendix D: Form for structuring the interview at George Washington University

Overview of the interview at George Washington University
Interviewer gives a general description of the research and the research question

Interview Part 1
Interviewer asks the respondent about his or her function within the academic unit, his or her experience in relation to using new forms of ICT in education and the experiences of the academic unit itself in relation to using new forms of ICT in education.

Interview Part 2
Interviewer relates the data as gathered from the first part of the interview to the following resear
Which factors are important in the decision of a university to start using new forms of ICT in education?

1a. To what extent are environmental pressures (government, changing student demographics, etc.) important?
1b. To what extent are technology developments (new possibilities, emerging technologies, etc.) important?
1c. To what extent are institutional conditions (policy, vision, concrete plans) important?
1d. To what extent are educational developments (focus on learner, active learning, individual learning, etc.) important?
1e. To what extent is cost-effectiveness (reducing costs, improving effects, etc.) important?
1f. To what extent are support facilities (administrative support, educational and technical support, etc.) important?

Interview Part 3
Interviewer explains the ICT Factors score table (see Appendix E) and asks the respondent to mark the factors that have been important in his or her situation in relation to the use of new forms of ICT in education.

Interview Part 4
Interviewer shows the respondent the results of the literature study in relation to the five OC questions and asks the respondent to react on these. During this part the following questions are asked:

- Does the use of new forms of ICT in education offer possibilities in relation to social and economical questions?
- How should ICT be used in order to create a useful learning process for students?
- How is ICT implemented in education? Which persons and processes are important before, during and after the implementation?

Interview Part 5
Interviewer shows the profiles that were the result of the literature study (as described in Chapter 6) and asks the respondent to put him or herself in one of the profiles

Appendix E: ICT Factor score table for respondents to indicate which ICT factors are important in the decision to use new forms of ICT in education

Date: ……. Name respondent: ……		
Category	**Factors**	✔
Environmental pressures	New market	
	Education as business	
	Part-time students	
	Lifelong learning	
	On-demand training	
	Funding	
	Partnerships	
	Tailor-made products	
	Dynamic environment	
	Competition	
	Response to threats and opportunities	
	Flexibility	
	Knowledge management	
	Changing student demographics	
	Demands from employers	
	Demands from learners	
	Emerging technology	
Technology developments	Dependence on IT	
	New technology (push, hype)	
	New organisational structure	
Institutional conditions	Broad participation	
	Shared vision	
	Concrete plans	
	Improved access to education	
	Leadership	
	New conceptions of learning	
Educational developments	New teaching models	
	Focus on learner/learning	
	Individual differences	
	Active learning	
	Reducing costs	
Cost reduction / Cost-effectiveness	Cost-effectiveness	
	Benefits	
Support facilities	Administrative support	
	Educational and technical support	
	Availability technology	
	Availability facilities	

Appendix F: List of variables used in the case studies

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Function of the respondent	88	1	8	4.68	2.08
Role of the respondent	88	1	3	1.91	0.80
University	88	1	4	2.25	1.19
Old and new universities	88	5	6	5.41	0.49
Universities in NL-BE and FI-SW	88	7	8	7.42	0.50
New form of ICT	88	1	6	4.94	1.50
Level of implementation	88	1	4	2.89	0.75
Cause	88	0	1	0.31	0.46
Constituents	88	0	2	0.89	0.44
Content	88	0	1	0.52	0.50
Control	88	0	1	0.74	0.44
Context	88	0	1	0.50	0.50
New market	88	0	1	0.32	0.47
Business education	88	0	1	0.24	0.43
Part-time students	88	0	1	0.58	0.50
Lifelong learning	88	0	1	0.51	0.50
On-demand training	88	0	1	0.27	0.45
Funding	88	0	1	0.32	0.47
Partnerships	88	0	1	0.36	0.48
Tailor-made products	88	0	1	0.22	0.41
Dynamic environment	88	0	1	0.39	0.49
Competition	88	0	1	0.36	0.48
Response to threats and opportunities	88	0	1	0.35	0.48
Flexibility	88	0	1	0.67	0.47
Knowledge management	88	0	1	0.19	0.40
Changing student demographics	88	0	1	0.35	0.48
Demands from employers	88	0	1	0.27	0.45
Demands from learners	88	0	1	0.44	0.50
Emerging technology	88	0	1	0.53	0.50
Dependence on IT	88	0	1	0.35	0.48
New technology (push, hype)	88	0	1	0.52	0.50
(New) organisational structure	88	0	1	0.22	0.41
Broad participation	88	0	1	0.43	0.50
Shared vision	88	0	1	0.41	0.49
Concrete plans	88	0	1	0.30	0.46
Improved access to education	88	0	1	0.59	0.49

Appendix F continues…

Appendix F (continued)

Leadership	88	0	1	0.33	0.47
New conceptions of learning	88	0	1	0.75	0.44
New teaching models	88	0	1	0.63	0.49
Focus on learner/learning	88	0	1	0.52	0.50
Individual differences	88	0	1	0.40	0.49
Active learning	88	0	1	0.72	0.45
Reducing costs	88	0	1	0.08	0.27
Cost-effectiveness	88	0	1	0.36	0.48
Benefits	88	0	1	0.50	0.50
Administrative support	88	0	1	0.49	0.50
Technical support	88	0	1	0.68	0.47
Availability technology	88	0	1	0.73	0.45
Availability facilities	88	0	1	0.70	0.46
Profiles	88	1	4	2.11	1.00

Appendix G: Raw data as used in the EUNITE case studies

Cases 1 - 9

Case number	1	2	3	4	5	6	7	8	9
Function of the respondent	support person faculty	policy advisor	teacher/ researcher	support person faculty	student	teacher/ researcher	teacher/ researcher	policy advisor	teacher/ researcher
Role of the respondent	support	Policy	instructors	support	instructors	instructors	instructors	policy	instructors
University	UT	UT	UT	UT	UT	UT	UT	UT	UT
Old and new universities	new university	New university	new university	new university	new university	new university	new university	new university	new university
Universities in countries	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE
New form of ICT	combination of applications incl. ele	Combination of applications incl. ele	websites and e-mail	electronic learning environment	combination of applications incl. ele	combination of applications incl. ele	combination of applications	combination of applications incl. ele	combination of applications incl. ele
Level of implementation	integrated in teaching and learning	integrated in teaching and learning	coordinated and supported activities	integrated in teaching and learning	integrated in teaching and learning	integrated in teaching and learning	coordinated and supported activities	integrated in teaching and learning	integrated in teaching and learning
Cause	social	economic	economic	economic	economic	social	social	social	social
Constituents	institutional	institutional	institutional	institutional	institutional	institutional	institutional	institutional	institutional
Content	consistency	constrains	constrains	constrains	consistency	constrains	consistency	consistency	constrains
Control	coercion	coercion	voluntary	coercion	coercion	coercion	voluntary	coercion	coercion
Context	uncertain	uncertain	interconnect edness	interconnect edness	uncertain	uncertain	uncertain	interconnect edness	uncertain
New market	yes	yes	yes	yes	yes	no	yes	no	yes
Business education	no	no	no	no	no	no	no	no	no

Part-time students	yes	yes	no	yes	no	yes	no	yes	no
Lifelong learning	no	yes	no	no	yes	yes	no	no	no
On-demand training	no	no	no	no	no	yes	yes	no	no
Funding	no	yes	no	no	no	yes	no	no	no
Partnerships	no	no	no	no	no	yes	no	yes	no
Tailor-made products	no	no	no	no	no	no	yes	no	no
Dynamic environment	no	no	no	yes	yes	yes	no	yes	no
Competition	no	yes	no	yes	no	yes	no	yes	no
Response to threats and opportunities	no	no	no	no	no	yes	no	yes	no
Flexibility	yes	yes	yes	yes	yes	yes	yes	no	yes
Knowledge management	no	no	no	no	yes	no	no	no	no
Changing student demographics	no	no	no	no	no	yes	no	yes	no
Demands from employers	no	yes	no	no	no	no	no	yes	no
Demands from learners	No	yes	no	no	yes	yes	yes	yes	no
Emerging technology	no	no	yes	no	no	no	yes	yes	yes
Dependence on IT	no	yes	yes	no	no	no	no	no	yes
New technology (push, hype)	no	no	yes	yes	no	no	no	yes	yes

(New) organis-ational structure	no	yes	no	no	no	no	no	no	yes
Broad participation	no	yes	no	no	no	no	no	no	yes
Shared vision	no	yes	no	yes	yes	yes	yes	no	no
Concrete plans	no	no	no	no	no	yes	yes	no	no
Improved access to education	no	yes	no	no	yes	yes	no	no	no
Leadership	no	no	no	no	no	yes	no	yes	no
New conceptions of learning	no	yes	yes	no	yes	no	yes	no	yes
New teaching models	yes	yes	yes	no	yes	yes	yes	no	yes
Focus on learner/learning	no	no	no	no	yes	yes	yes	yes	yes
Individual differences	yes	no	no	no	yes	yes	yes	no	no
Active learning	yes	no	no	yes	yes	yes	yes	yes	yes
Reducing costs	no	no	no	no	no	no	no	no	no
Cost-effectiveness	no	no	no	no	no	no	yes	no	no
Benefits	yes	yes	no	yes	no	yes	yes	yes	yes
Administrative support	yes	yes	no	yes	yes	yes	yes	yes	no
Technical support	yes	yes	yes	yes	yes	yes	yes	yes	yes
Availability technology	no	yes	yes	yes	yes	no	yes	yes	yes
Availability facilities	no	yes	yes	yes	yes	yes	yes	yes	yes
Profile	1	2	3	3	2	1	1	4	1

Cases 10 - 18

Case number	10	11	12	13	14	15	16	17	18
Function of the respondent	head of department	support unit (educ.)	teacher/ researcher	support person faculty	(vice)rector/ policy	teacher/ researcher	policy advisor	teacher/ researcher	support unit (techn.)
Role of the respondent	Policy	support	instructors	support	policy	instructors	policy	instructors	support
University	UT	UT	UT	UT	UT	UT	UT	UT	UT
Old and new universities	New university	new university	new university	new university	new university	new university	new university	new university	new university
Universities in countries	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE
New form of ICT	Combination of applications incl. ele	electronic learning environment	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	electronic learning environment	combination of applications incl. ele	electronic learning environment	combination of applications incl. ele
Level of implementation	Coordinated and supported activities	coordinated and supported activities	coordinated and supported activities	integrated in teaching and learning	coordinated and supported activities	integrated in teaching and learning	coordinated and supported activities	integrated in teaching and learning	coordinated and supported activities
Cause	social	social	social	economic	social	social	social	economic	social
Constituents	institutional	institutional	institutional	institutional	institutional	institutional	institutional	institutional	institutional
Content	constrains	constrains	constrains	constrains	consistency	constrains	constrains	constrains	consistency
Control	voluntary	voluntary	voluntary	coercion	voluntary	coercion	voluntary	coercion	coercion
Context	interconnect edness	interconnect edness	uncertain	uncertain	uncertain	uncertain	uncertain	uncertain	uncertain
New market	yes	no	yes	no	no	yes	no	yes	no
Business education	no	no	no	no	no	no	yes	yes	no
Part-time students	no	yes	no	yes	yes	yes	yes	no	no
Lifelong learning	no	no	no	yes	yes	yes	yes	yes	no

On-demand training	no	no	yes	no	no	yes	no	no	no
Funding	no	yes	no	no	no	no	no	no	yes
Partnerships	no	yes	no	no	yes	yes	yes	no	no
Tailor-made products	no	no	no	yes	no	yes	no	no	no
Dynamic environment	no	no	no	yes	no	no	yes	no	no
Competition	no	yes	no	yes	no	no	no	no	yes
Response to threats and opportunities	no	yes	no	no	yes	no	yes	no	yes
Flexibility	yes	yes	yes	yes	yes	yes	yes	yes	yes
Knowledge management	no	no	yes	yes	no	yes	no	yes	no
Changing student demographics	no	yes	no	no	no	no	no	no	no
Demands from employers	yes	no	no	no	no	no	no	no	no
Demands from learners	yes	no	no	no	no	no	yes	no	no
Emerging technology	yes	yes	no	yes	no	yes	no	no	yes
Dependence on IT	no	no	no	no	yes	no	no	no	no
New technology (push, hype)	yes	yes	no	no	no	no	yes	yes	yes
(New) organisational structure	no	no	no	yes	no	yes	no	yes	no

Broad participation	yes	yes	no	no	no	no	no	yes	no
Shared vision	no	yes	no	no	no	no	no	no	yes
Concrete plans	no	yes	no	no	no	yes	no	no	no
Improved access to education	no	no	yes	yes	yes	yes	no	no	no
Leadership	no	yes	no	yes	yes	no	no	no	yes
New conceptions of learning	yes	yes	yes	yes	yes	yes	yes	yes	yes
New teaching models	yes	yes	yes	yes	no	yes	no	yes	no
Focus on learner/learning	no	yes	yes	no	no	yes	no	yes	no
Individual differences	yes	yes	no	no	no	no	no	yes	no
Active learning	no	yes	yes	yes	yes	yes	no	yes	no
Reducing costs	no	no	no	no	no	no	no	no	no
Cost-effectiveness	no	no	no	no	no	yes	no	no	no
Benefits	no	no	yes	no	no	no	no	yes	yes
Administrative support	yes	no	no	yes	yes	yes	yes	no	yes
Technical support	no	yes	yes	yes	yes	yes	yes	no	yes
Availability technology	yes	yes	no	yes	yes	yes	yes	yes	yes
Availability facilities	yes	yes	yes	yes	yes	no	yes	yes	yes
Profile	4	4	1	2	1	1	1	2	1

Cases 19 - 27

Case number	19	20	21	22	23	24	25	26	27
Function of the respondent	head of department	Teacher/ researcher	support person faculty	head of department	support person faculty	head of department	support unit (educ.)	head of department	support person faculty
Role of the respondent	policy	instructors	support	policy	support	policy	support	policy	support
University	UT	UT	UT	UT	UT	UT	UT	UT	UT
Old and new universities	new university	new university	new university	new university	new university	new university	new university	new university	new university
Universities in countries	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE
New form of ICT	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele
Level of implementation	coordinated and supported activities	coordinated and supported activities	coordinated and supported activities	coordinated and supported activities	coordinated and supported activities	integrated in teaching and learning	coordinated and supported activities	coordinated and supported activities	coordinated and supported activities
Cause	social	social	social	social	economic	economic	economic	social	economic
Constituents	institutional	multiplicity	institutional	institutional	institutional	institutional	multiplicity	institutional	institutional
Content	consistency	constrains	constrains	consistency	consistency	consistency	consistency	constrains	consistency
Control	coercion	voluntary	coercion	voluntary	coercion	coercion	coercion	voluntary	coercion
Context	uncertain	uncertain	uncertain	interconnect edness	interconnect edness	uncertain	uncertain	interconnect edness	interconnect edness
New market	yes	yes	yes	yes	yes	no	no	yes	yes
Business education	no	no	no	no	no	no	yes	no	no
Part-time students	yes	no	no	no	yes	yes	yes	no	yes
Lifelong learning	yes	no	no	no	no	yes	yes	no	yes

On-demand training	no	no	no	no	no	no	yes	no	yes
Funding	no	no	yes	no	yes	no	no	no	yes
Partnerships	no	no	no	yes	no	no	yes	no	no
Tailor-made products	no	no	yes	yes	no	yes	yes	no	yes
Dynamic environment	no	no	yes	yes	no	yes	yes	no	no
Competition	yes	no	no	no	yes	yes	yes	no	no
Response to threats and opportunities	no	no	no	no	no	yes	yes	no	no
Flexibility	no	yes	yes	no	no	yes	yes	yes	no
Knowledge management	no	no	no	no	no	no	no	no	no
Changing student demographics	no	no	no	no	no	yes	yes	no	no
Demands from employers	no	yes	no	no	no	no	yes	yes	no
Demands from learners	no	no	no	no	no	yes	yes	yes	no
Emerging technology	yes	yes	no	yes	no	yes	yes	yes	yes
Dependence on IT	no	no	no	no	no	no	no	no	no
New technology (push, hype)	no	no	yes	yes	yes	yes	yes	yes	no
(New) organisational structure	no	yes	no	no	no	no	yes	no	no

Broad participation	no	no	yes	no	no	yes	yes	yes	no
Shared vision	no	no	no	no	no	no	yes	no	yes
Concrete plans	yes	no	no	no	no	yes	yes	no	no
Improved access to education	yes	yes	yes	yes	no	yes	yes	no	yes
Leadership	no	no	yes	yes	no	yes	yes	no	yes
New conceptions of learning	yes	yes	yes	no	no	no	no	yes	no
New teaching models	no	no	yes	no	no	yes	no	yes	no
Focus on learner/learning	yes	no	no	no	no	yes	yes	no	no
Individual differences	no	yes	no	yes	no	yes	yes	yes	no
Active learning	yes	no	yes	yes	yes	yes	yes	no	yes
Reducing costs	no	no	no	no	no	no	yes	no	yes
Cost-effectiveness	yes	no	yes	no	no	no	yes	no	no
Benefits	no	no	no	no	no	yes	yes	no	no
Administrative support	yes	no	yes	no	yes	yes	yes	yes	yes
Technical support	yes	no	yes	no	yes	yes	yes	no	yes
Availability technology	yes	no	yes	yes	yes	yes	yes	yes	yes
Availability facilities	yes	yes	yes	yes	yes	yes	yes	yes	yes
Profile	1	1	1	4	3	2	2	4	3

Cases 28 - 36

Case number	28	29	30	31	32	33	34	35	36
Function of the respondent	support person faculty	support unit (educ.)	policy advisor	teacher/ researcher	head of department	teacher/ researcher	head of department	support unit (educ.)	support person faculty
Role of the respondent	support	support	policy	instructors	policy	instructors	policy	support	support
University	UT	UT	UT	UT	UT	UT	UT	KUL	KUL
Old and new universities	new university	new university	new university	new university	new university	new university	new university	old university	old university
Universities in countries	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE
New form of ICT	electronic learning environment	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	combination of applications	combination of applications incl. ele
Level of implementation	integrated in teaching and learning	coordinated and supported activities	coordinated and supported activities	coordinated and supported activities	integrated in teaching and learning	integrated in teaching and learning	coordinated and supported activities	increasing awareness, at all levels	coordinated and supported activities
Cause	economic	social	economic	economic	social	social	social	social	social
Constituents	institutional	institutional	institutional	institutional	institutional	institutional	institutional	institutional	multiplicity
Content	constrains	constrains	consistency	constrains	constrains	constrains	constrains	constrains	constrains
Control	coercion	voluntary	voluntary	coercion	coercion	coercion	coercion	voluntary	voluntary
Context	uncertain	interconnect edness	uncertain	uncertain	uncertain	uncertain	interconnect edness	interconnect edness	interconnect edness
New market	no	yes	yes	yes	yes	no	yes	yes	yes
Business education	no	no	no	no	no	no	no	no	yes
Part-time students	yes	yes	no	no	yes	yes	no	no	yes
Lifelong learning	no	yes	no	no	no	no	no	no	yes

On-demand training	no	no	no	no	no	no	yes	no	yes
Funding	no	no	no	no	no	yes	no	no	no
Partnerships	no	no	no	no	no	yes	yes	no	yes
Tailor-made products	no	no	no	no	no	yes	no	no	yes
Dynamic environment	yes	no	no	no	no	no	yes	no	no
Competition	no	yes	no	no	yes	no	yes	no	no
Response to threats and opportunities	no	no	no	no	yes	yes	yes	no	yes
Flexibility	no	yes	no	no	yes	yes	no	yes	no
Knowledge management	no	no	no	no	yes	no	no	no	yes
Changing student demographics	yes	no	yes	no	no	no	yes	no	yes
Demands from employers	no	no	no	no	no	no	no	no	yes
Demands from learners	yes	no	no	no	no	no	no	no	yes
Emerging technology	no	no	no	yes	yes	yes	yes	no	no
Dependence on IT	no	no	no	yes	yes	no	yes	no	no
New technology (push, hype)	yes	yes	yes	yes	no	yes	yes	no	no
(New) organisational structure	no	no	no	yes	no	yes	no	no	no

Broad participation	no	yes	yes	no	no	no	no	no	yes
Shared vision	yes	no	no	no	yes	yes	no	no	yes
Concrete plans	no	no	no	no	yes	no	no	no	yes
Improved access to education	yes	no	no	yes	yes	yes	no	no	no
Leadership	no	no	no	no	yes	no	no	no	no
New conceptions of learning	yes	no	no	no	no	no	yes	yes	yes
New teaching models	no	no	no	no	yes	no	yes	yes	yes
Focus on learner/learning	no	yes	no	no	no	no	yes	yes	yes
Individual differences	no	no	no	no	yes	yes	no	yes	no
Active learning	no	yes	no	no	yes	no	yes	yes	yes
Reducing costs	no	no	no	no	no	no	no	no	no
Cost-effectiveness	no	yes	no	yes	no	yes	yes	no	yes
Benefits	no	no	yes	yes	yes	no	no	no	yes
Administrative support	yes	no	no	yes	yes	no	yes	no	no
Technical support	yes	no	no	yes	yes	no	no	no	no
Availability technology	yes	no	yes	no	yes	yes	yes	no	no
Availability facilities	yes	yes	no	yes	yes	no	yes	no	no
Profile	2	4	2	2	1	1	4	4	4

Cases 37 - 45

Case number	37	38	39	40	41	42	43	44	45
Function of the respondent	support person faculty	Support person faculty	head of department	support unit (educ.)	support unit (educ.)	(vice)rector/ policy	teacher/ researcher	policy advisor	policy advisor
Role of the respondent	support	Support	policy	support	support	policy	instructors	policy	policy
University	KUL	KUL	KUL	KUL	KUL	KUL	KUL	KUL	KUL
Old and new universities	old university	Old university	old university	old university	old university	old university	old university	old university	old university
Universities in countries	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE
New form of ICT	combination of applications	Websites and e-mail	videoconferencing	combination of applications	combination of applications	combination of applications	combination of applications	combination of applications	combination of applications
Level of implementation	increasing awareness, at all levels	Incidental, one or more teachers	incidental, one or more teachers	coordinated and supported activities	increasing awareness, at all levels	coordinated and supported activities	increasing awareness, at all levels	coordinated and supported activities	increasing awareness, at all levels
Cause	social	social	economic	social	social	social	social	social	social
Constituents	institutional	institutional	institutional	institutional	institutional	institutional	multiplicity	multiplicity	institutional
Content	constrains	constrains	constrains	constrains	constrains	constrains	consistency	consistency	constrains
Control	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary
Context	interconnectedness	uncertain	interconnectedness	uncertain	interconnectedness	interconnectedness	interconnectedness	interconnectedness	uncertain
New market	yes	yes	no	yes	yes	no	yes	yes	no
Business education	no	no	yes	no	no	yes	no	no	yes
Part-time students	no	yes	no	no	no	no	no	no	yes
Lifelong learning	yes	no	yes	yes	no	yes	no	no	yes

On-demand training	yes	no	no	no	no	yes	no	no	yes
Funding	no	no	no	no	no	no	yes	no	no
Partnerships	no	yes	yes	no	no	yes	yes	no	yes
Tailor-made products	no	no	no	no	no	yes	no	no	yes
Dynamic environment	no	yes	no	no	no	yes	yes	no	yes
Competition	no	no	no	yes	no	yes	no	no	no
Response to threats and opportunities	no	yes	no	no	no	yes	no	no	yes
Flexibility	yes	yes	yes	no	no	yes	no	no	yes
Knowledge management	no	no	yes	no	no	no	no	no	yes
Changing student demographics	no	yes	yes	yes	no	yes	no	yes	no
Demands from employers	yes	no	no	no	no	yes	no	no	yes
Demands from learners	yes	no	no	no	no	yes	no	no	yes
Emerging technology	yes	no	no	no	no	yes	yes	no	yes
Dependence on IT	no	no	no	no	no	yes	no	no	yes
New technology (push, hype)	yes	yes	no	no	no	yes	no	yes	no
(New) organisational structure	no	yes	no	no	no	yes	no	no	yes

Broad participation	yes	yes	yes	no	no	yes	yes	no	yes
Shared vision	yes	yes	yes	no	yes	yes	yes	no	yes
Concrete plans	yes	yes	yes	no	yes	yes	no	no	no
Improved access to education	yes	yes	yes	yes	no	yes	no	no	yes
Leadership	no	yes	yes	no	no	yes	no	no	yes
New conceptions of learning	yes	yes	yes	yes	yes	yes	yes	yes	yes
New teaching models	yes	yes	no	yes	no	yes	no	yes	yes
Focus on learner/learning	yes	yes	no	no	yes	yes	no	no	yes
Individual differences	no	yes	no	no	yes	no	yes	no	yes
Active learning	yes	yes	no	no	yes	yes	yes	no	yes
Reducing costs	no	no	no	no	no	no	no	no	no
Cost-effectiveness	no	no	no	no	no	yes	no	no	yes
Benefits	yes	yes	yes	no	no	yes	no	yes	yes
Administrative support	yes	yes	no	no	no	yes	yes	no	no
Technical support	yes	no	yes	no	no	yes	yes	no	yes
Availability technology	yes	yes	yes	yes	no	yes	yes	yes	yes
Availability facilities	yes	yes	no	yes	no	yes	yes	no	no
Profile	4	1	3	1	4	4	4	4	1

Cases 46 - 54

Case number	46	47	48	49	50	51	52	53	54
Function of the respondent	teacher/ researcher	Support unit (educ.)	support unit (educ.)	support person faculty	support person faculty	head of department	head of department	support person faculty	support unit (educ.)
Role of the respondent	instructors	Support	support	support	support	policy	policy	support	support
University	KUL	KUL	KUL	KUL	KUL	KUL	HUT	HUT	HUT
Old and new universities	old university	Old university	old university	old university	old university	old university	new university	new university	new university
Universities in countries	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	NL-BE	FI-SW	FI-SW	FI-SW
New form of ICT	combination of applications	Combination of applications	combination of applications	combination of applications incl. ele	combination of applications	websites and e-mail	combination of applications	combination of applications	combination of applications
Level of implementation	increasing awareness, at all levels	Increasing awareness, at all levels	increasing awareness, at all levels	coordinated and supported activities	increasing awareness, at all levels	increasing awareness, at all levels	coordinated and supported activities	increasing awareness, at all levels	coordinated and supported activities
Cause	economic	Social	social	social	social	economic	social	social	social
Constituents	institutional	multiplicity	institutional	multiplicity	institutional	multiplicity	institutional	institutional	both
Content	consistency	constrains	consistency	constrains	constrains	consistency	consistency	consistency	consistency
Control	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary
Context	uncertain	uncertain	uncertain	interconnect edness	interconnect edness	uncertain	uncertain	uncertain	interconnect edness
New market	yes	no	yes	no	yes	yes	yes	no	no
Business education	no	yes	no	yes	no	yes	no	yes	no
Part-time students	no	no	no	yes	yes	yes	no	yes	yes
Lifelong learning	no	yes	yes	yes	no	yes	no	yes	yes

On-demand training	no	no	no	yes	yes	yes	no	no	no
Funding	no	yes	no	no	no	no	yes	no	yes
Partnerships	no	yes	no	no	no	yes	yes	yes	yes
Tailor-made products	no	no	no	no	no	no	no	yes	no
Dynamic environment	no	no	yes	no	no	no	yes	yes	yes
Competition	no	yes	no	no	no	yes	no	yes	yes
Response to threats and opportunities	yes	yes	no	no	no	yes	no	yes	no
Flexibility	yes	no	yes	yes	yes	yes	yes	yes	yes
Knowledge management	no	no	no	no	no	no	no	yes	no
Changing student demographics	no	no	no	yes	yes	yes	no	yes	no
Demands from employers	no	yes	no	no	no	yes	no	yes	no
Demands from learners	no	no	no	no	yes	yes	yes	yes	yes
Emerging technology	no	yes	yes	no	yes	yes	yes	no	yes
Dependence on IT	no	yes	no	no	no	yes	yes	yes	no
New technology (push, hype)	no	yes	no	yes	no	no	no	no	yes
(New) organisational structure	no	no	no	no	no	no	yes	yes	yes

Broad participation	yes	yes	no	no	no	no	no	yes	yes
Shared vision	no	no	yes	yes	yes	yes	yes	no	no
Concrete plans	no	yes	yes	no	no	yes	no	no	no
Improved access to education	yes	no	yes	no	no	yes	yes	yes	yes
Leadership	no	yes	no	no	no	no	no	yes	no
New conceptions of learning	yes	no	no	yes	yes	yes	yes	yes	yes
New teaching models	yes	no	no	no	no	no	yes	yes	yes
Focus on learner/learning	no	yes	no	no	no	no	no	yes	yes
Individual differences	no	no	no	no	no	yes	no	yes	yes
Active learning	yes	yes	yes	no	no	yes	yes	yes	yes
Reducing costs	no	no	no	no	no	no	no	no	yes
Cost-effectiveness	no	yes	no	no	no	yes	yes	no	yes
Benefits	no	yes	yes	yes	yes	no	yes	no	no
Administrative support	no	yes	no	no	no	no	no	no	no
Technical support	no	yes	yes	yes	yes	yes	yes	yes	no
Availability technology	no	yes	yes	no	no	yes	yes	yes	no
Availability facilities	no	yes	yes	no	no	yes	no	yes	yes
Profile	2	1	1	4	4	2	1	1	4

Cases 55 - 63

Case number	55	56	57	58	59	60	61	62	63
Function of the respondent	teacher/ researcher	Head of department	support unit (educ.)	teacher/ researcher	support person faculty	teacher/ researcher	support person faculty	student	head of department
Role of the respondent	instructors	policy	support	instructors	support	instructors	support	instructors	policy
University	HUT	HUT	HUT	HUT	HUT	HUT	HUT	HUT	HUT
Old and new universities	new university	new university	new university	new university	new university	new university	new university	new university	new university
Universities in countries	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW
New form of ICT	combination of applications	combination of applications	combination of applications	combination of applications	combination of applications	CBT	combination of applications	combination of applications	combination of applications
Level of implementation	increasing awareness, at all levels	coordinated and supported activities	coordinated and supported activities	increasing awareness, at all levels	coordinated and supported activities	increasing awareness, at all levels	coordinated and supported activities	coordinated and supported activities	incidental, one or more teachers
Cause	social	social	social	social	social	social	economic	economic	social
Constituents	institutional	both	institutional	institutional	institutional	institutional	institutional	multiplicity	institutional
Content	consistency	consistency	consistency	consistency	constrains	consistency	constrains	consistency	consistency
Control	voluntary	coercion	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary
Context	uncertain	interconnect edness	uncertain	interconnect edness	interconnect edness	uncertain	uncertain	interconnect edness	interconnect edness
New market	yes	yes	no	no	yes	yes	yes	yes	yes
Business education	no	no	yes	no	no	no	no	no	no
Part-time students	yes	yes	yes	yes	no	yes	yes	no	no
Lifelong learning	no	yes	no	yes	no	yes	no	no	no

On-demand training	no	no	no	yes	no	yes	no	no	no
Funding	no	no	yes	no	yes	no	no	no	no
Partnerships	no	no	yes	no	yes	no	no	no	no
Tailor-made products	no	no	no	no	no	yes	no	no	no
Dynamic environment	no	yes	yes	yes	no	no	yes	yes	no
Competition	no	yes	no	yes	no	no	no	no	no
Response to threats and opportunities	no	yes	yes	no	no	yes	yes	no	no
Flexibility	no	yes	yes	no	no	yes	yes	yes	no
Knowledge management	no	yes	no	no	no	no	no	yes	no
Changing student demographics	no	yes	no	yes	no	yes	yes	no	no
Demands from employers	no	no	yes	no	no	yes	no	no	yes
Demands from learners	yes	no	yes	yes	yes	yes	no	no	no
Emerging technology	yes	yes	yes	no	no	yes	yes	no	no
Dependence on IT	no	no	yes	yes	no	no	no	no	yes
New technology (push, hype)	no	yes	no	yes	no	no	yes	no	no
(New) organisational structure	no	no	no	no	yes	no	no	no	no

Broad participation	no	yes	no	no	yes	yes	yes	no	no
Shared vision	yes	yes	no	no	no	no	no	yes	no
Concrete plans	no	no	no	no	yes	no	no	no	no
Improved access to education	no	yes	no	no	yes	yes	yes	no	no
Leadership	no	no	no	yes	no	no	no	no	no
New conceptions of learning	yes	yes	yes	yes	yes	yes	yes	no	no
New teaching models	no	yes	yes	yes	yes	yes	yes	no	yes
Focus on learner/learning	no	yes	yes	no	yes	yes	yes	yes	no
Individual differences	no	no	yes	no	yes	yes	yes	no	no
Active learning	yes	yes	yes	no	yes	yes	yes	yes	no
Reducing costs	no	yes	no	no	no	no	no	no	no
Cost-effectiveness	no	yes	no	no	yes	no	yes	yes	no
Benefits	no	yes	no	no	no	yes	yes	no	no
Administrative support	no	no	no	no	no	yes	yes	yes	no
Technical support	yes	no	no	no	yes	yes	no	no	yes
Availability technology	yes	no	no	yes	no	yes	yes	yes	no
Availability facilities	yes	no	no	yes	no	yes	yes	no	no
Profile	1	4	1	4	4	1	2	3	4

Cases 64 - 72

Case number	64	65	66	67	68	69	70	71	72
Function of the respondent	teacher/ researcher	support person faculty	(vice)rector/ policy	policy advisor	policy advisor	student	student	policy advisor	(vice)rector/ policy
Role of the respondent	instructors	support	policy	policy	policy	instructors	instructors	policy	policy
University	HUT	HUT	HUT	HUT	HUT	HUT	LU	LU	LU
Old and new universities	new university	new university	new university	new university	new university	new university	old university	old university	old university
Universities in countries	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW
New form of ICT	combination of applications	combination of applications	combination of applications	combination of applications	combination of applications	combination of applications	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele
Level of implementation	coordinated and supported activities	increasing awareness, at all levels	coordinated and supported activities	coordinated and supported activities	coordinated and supported activities	coordinated and supported activities	integrated in teaching and learning	coordinated and supported activities	coordinated and supported activities
Cause	economic	social	social	social	social	economic	social	social	social
Constituents	institutional	institutional	institutional	institutional	institutional	multiplicity	both	institutional	institutional
Content	constrains	consistency	consistency	constrains	consistency	consistency	constrains	consistency	constrains
Control	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary
Context	uncertain	uncertain	interconnect edness	uncertain	uncertain	interconnect edness	interconnect edness	interconnect edness	uncertain
New market	yes	yes	yes	yes	yes	yes	yes	yes	no
Business education	no	no	no	no	no	no	yes	yes	yes
Part-time students	yes	no	yes	yes	yes	no	yes	no	yes
Lifelong learning	no	yes	yes	yes	yes	yes	yes	no	yes

On-demand training	yes	no	no	no	no	no	no	no	yes
Funding	yes	yes	no	yes	no	yes	yes	no	no
Partnerships	yes	no	no	yes	yes	no	no	yes	yes
Tailor-made products	no	no	no	no	no	no	no	no	yes
Dynamic environment	yes	yes	no	no	yes	no	yes	no	yes
Competition	yes	no	yes	yes	yes	no	no	no	yes
Response to threats and opportunities	no	no	no	no	yes	no	yes	yes	yes
Flexibility	yes	yes	no	yes	yes	no	yes	no	yes
Knowledge management	no	yes	no	no	no	no	no	no	no
Changing student demographics	yes	no	no	no	no	no	no	no	no
Demands from employers	no	yes	yes	no	yes	no	no	no	yes
Demands from learners	no	yes	yes	yes	yes	no	no	no	yes
Emerging technology	no	yes	no	no	yes	no	yes	yes	no
Dependence on IT	yes	yes	yes	no	yes	yes	no	yes	yes
New technology (push, hype)	no	yes	no	yes	yes	no	yes	no	no
(New) organisational structure	no	no	no	no	yes	yes	no	no	no

Broad participation	yes	yes	yes	no	yes	no	no	yes	yes
Shared vision	yes	yes	no	no	yes	no	no	yes	no
Concrete plans	no	yes	no	no	yes	no	yes	yes	yes
Improved access to education	no	yes	no	no	yes	no	yes	yes	yes
Leadership	no	no	yes	no	yes	no	no	yes	yes
New conceptions of learning	yes	no	yes	yes	yes	no	yes	yes	yes
New teaching models	no	yes	yes	yes	yes	no	yes	no	yes
Focus on learner/learning	yes	no	yes	yes	yes	no	yes	yes	yes
Individual differences	no	no	no	no	no	no	yes	yes	yes
Active learning	yes	yes	no	yes	no	no	yes	no	yes
Reducing costs	no	no	no	no	no	yes	yes	no	no
Cost-effectiveness	yes	yes	no	no	yes	yes	yes	no	no
Benefits	yes	yes	yes	yes	yes	no	yes	yes	yes
Administrative support	no	yes	yes	no	yes	no	yes	yes	yes
Technical support	no	yes	no	yes	yes	no	yes	yes	yes
Availability technology	yes	yes	no	yes	no	yes	yes	yes	no
Availability facilities	yes	yes	yes	yes	no	yes	yes	yes	yes
Profile	2	1	4	1	1	3	4	4	1

Cases 73 - 81

Case number	73	74	75	76	77	78	79	80	81
Function of the respondent	support unit (educ.)	policy advisor	head of department	head of department	support unit (techn.)	support unit (techn.)	policy advisor	teacher/ researcher	policy advisor
Role of the respondent	support	policy	policy	policy	support	support	policy	instructors	policy
University	LU	LU	LU	LU	LU	LU	LU	LU	LU
Old and new universities	old university	old university	old university	old university	old university	old university	old university	old university	old university
Universities in countries	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW
New form of ICT	combination of applications incl. ele	combination of applications incl. ele	combination of applications	websites and e-mail	combination of applications	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele	combination of applications incl. ele
Level of implementation	coordinated and supported activities	coordinated and supported activities	increasing awareness, at all levels	incidental, one or more teachers	coordinated and supported activities	coordinated and supported activities	coordinated and supported activities	coordinated and supported activities	coordinated and supported activities
Cause	social	social	social	social	economic	economic	social	economic	economic
Constituents	multiplicity	institutional	institutional	multiplicity	institutional	multiplicity	institutional	institutional	institutional
Content	consistency	constrains	constrains	consistency	consistency	consistency	constrains	constrains	consistency
Control	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary
Context	interconnectedness	interconnectedness	interconnectedness	interconnectedness	interconnectedness	interconnectedness	interconnectedness	uncertain	interconnectedness
New market	no	yes	no	yes	no	yes	no	no	no
Business education	yes	no	no	yes	no	no	no	yes	yes
Part-time students	yes	yes	no	no	yes	yes	yes	yes	yes
Lifelong learning	yes	yes	no	no	yes	yes	yes	yes	yes

On-demand training	yes	no	no	no	yes	no	yes	yes	no
Funding	yes	no	no	yes	no	yes	yes	yes	no
Partnerships	yes	no	no	no	no	no	no	yes	yes
Tailor-made products	yes	no	yes	no	no	no	no	yes	no
Dynamic environment	yes	yes	no	no	no	yes	no	yes	no
Competition	yes	no	no	no	no	yes	no	no	yes
Response to threats and opportunities	yes	no	no	no	yes	no	no	yes	yes
Flexibility	yes	no	no	no	yes	yes	yes	yes	no
Knowledge management	yes	no	no	no	yes	no	yes	no	yes
Changing student demographics	yes	yes	no	no	no	yes	yes	yes	yes
Demands from employers	yes	no	no	no	no	no	yes	no	no
Demands from learners	yes	no	yes	no	yes	no	yes	no	yes
Emerging technology	yes	no	no	yes	no	no	yes	yes	no
Dependence on IT	yes	yes	no	yes	yes	no	yes	no	no
New technology (push, hype)	yes	yes	yes	yes	yes	yes	yes	no	no
(New) organisational structure	yes	no	no	no	no	no	no	no	no

Broad participation	yes	no	no	no	yes	no	yes	yes	yes
Shared vision	yes	no	no	no	yes	no	no	yes	no
Concrete plans	yes	no	no	no	no	no	no	yes	no
Improved access to education	yes	yes	yes	no	yes	yes	yes	yes	yes
Leadership	yes	no	no	no	no	no	yes	yes	yes
New conceptions of learning	yes	yes	yes	yes	no	yes	yes	yes	yes
New teaching models	yes	yes	yes	no	yes	yes	yes	yes	yes
Focus on learner/learning	yes	yes	no	no	no	yes	yes	yes	yes
Individual differences	yes	no	no	no	yes	yes	no	yes	yes
Active learning	yes	yes	yes	no	yes	yes	yes	yes	yes
Reducing costs	no	no	no	no	no	no	no	no	no
Cost-effectiveness	yes	no	no	no	yes	no	yes	no	yes
Benefits	yes	no	no	no	yes	no	yes	yes	yes
Administrative support	yes	no	no	no	no	no	yes	yes	no
Technical support	yes	yes	no	yes	yes	yes	yes	yes	no
Availability technology	yes	yes	yes	yes	yes	no	yes	yes	no
Availability facilities	yes	yes	yes	yes	yes	no	yes	yes	no
Profile	4	4	4	4	3	3	4	2	3

Cases 82 - 88

Case number	82	83	84	85	86	87	88
Function of the respondent	policy advisor	teacher/ researcher	head of department	teacher/ researcher	support person faculty	support unit (educ.)	teacher/ researcher
Role of the respondent	policy	instructors	policy	instructors	support	support	instructors
University	LU	LU	LU	LU	LU	LU	LU
Old and new universities	old university	old university	old university	old university	old university	old university	old university
Universities in countries	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW	FI-SW
New form of ICT	combination of applications	websites and e-mail	combination of applications	websites and e-mail	combination of applications incl. ele	electronic learning environment	combination of applications incl. ele
Level of implementation	increasing awareness, at all levels	increasing awareness, at all levels	coordinated and supported activities	coordinated and supported activities	integrated in teaching and learning	coordinated and supported activities	coordinated and supported activities
Cause	social	economic	social	economic	social	economic	social
Constituents	institutional	institutional	institutional	institutional	both	institutional	multiplicity
Content	constrains	consistency	constrains	consistency	constrains	consistency	consistency
Control	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary	voluntary
Context	interconnect edness	interconnect edness	interconnect edness	uncertain	interconnect edness	uncertain	interconnect edness
New market	yes	yes	yes	yes	yes	no	yes
Business education	no	no	no	no	yes	yes	no
Part-time students	yes	no	yes	yes	yes	no	yes
Lifelong learning	yes	no	no	no	yes	no	yes

On-demand training	no	no	no	yes	yes	no	no
Funding	no	yes	yes	no	yes	no	yes
Partnerships	no	no	no	no	yes	no	no
Tailor-made products	no	yes	no	no	no	no	no
Dynamic environment	no	no	no	no	no	no	no
Competition	no	no	yes	no	no	yes	no
Response to threats and opportunities	no	no	no	no	no	no	no
Flexibility	no	yes	no	yes	yes	no	yes
Knowledge management	no	no	no	no	no	no	no
Changing student demographics	yes	no	no	no	no	no	yes
Demands from employers	no	no	no	yes	no	no	yes
Demands from learners	no	yes	no	no	yes	yes	yes
Emerging technology	yes	yes	no	no	yes	yes	no
Dependence on IT	yes	no	no	no	yes	no	yes
New technology (push, hype)	yes	no	yes	no	yes	yes	no
(New) organisational structure	no	no	no	no	no	no	no

Broad participation	no	no	no	yes	no	no	no
Shared vision	no	no	yes	no	no	no	no
Concrete plans	no	no	no	no	yes	no	no
Improved access to education	yes	no	no	yes	yes	yes	yes
Leadership	yes	no	no	no	yes	no	no
New conceptions of learning	no	yes	yes	yes	yes	yes	yes
New teaching models	yes	yes	no	no	yes	yes	no
Focus on learner/learning	no	yes	no	no	no	yes	yes
Individual differences	no	yes	no	no	no	no	no
Active learning	no	yes	yes	yes	yes	no	yes
Reducing costs	no	no	no	no	no	yes	no
Cost-effectiveness	yes	no	no	yes	yes	no	no
Benefits	no	yes	no	no	no	no	no
Administrative support	no	no	yes	no	yes	no	no
Technical support	no	yes	yes	yes	yes	yes	yes
Availability technology	no	yes	no	yes	yes	yes	yes
Availability facilities	no	no	no	yes	yes	yes	no
Profile	4	3	4	2	4	2	4

Appendix H: Structure for the interviews at the four EUNITE universities

Overview of the interview at the EUNITE case studies
Interviewer gives a general description of the research and the research question

Interview Part 1
Interviewer asks the respondent about his or her function within the academic unit, his or her experience in relation to using new forms of ICT in education and the experiences of the academic unit itself in relation to using new forms of ICT in education.

Interview Part 2
Interviewer relates the data as gathered from the first part of the interview to the following research questions:

1. Which factors are important in the decision of a university to start using new forms of ICT in education?
   - 1a. To what extent are environmental pressures (government, changing student demographics, etc.) important?
   - 1b. To what extent are technology developments (new possibilities, emerging technologies, etc.) important?
   - 1c. To what extent are institutional conditions (policy, vision, concrete plans) important?
   - 1d. To what extent are educational developments (focus on learner, active learning, individual learning, etc.) important?
   - 1e. To what extent is cost-effectiveness (reducing costs, improving effects, etc.) important?
   - 1f. To what extent are support facilities (administrative support, educational and technical support, etc.) important?

Interview Part 3
Interviewer explains the ICT Factors score table (see Appendix E) and asks the respondent to mark the factors that have been important in his or her situation in relation to the use of new forms of ICT in education.

Interview Part 4
Interviewer shows the respondent the results of the literature study in relation to the five OC questions and asks the respondent to react on these. During this part the following questions are asked:

2. Is your university / faculty influenced by economic or social reasons to use ICT in education?
3. Who has been involved in the decision to use ICT in your university / faculty?
4. Has the use of new forms of ICT in education been consistent with previous practice or are there constraints?
5. Is the use of new forms of ICT in education voluntary or is there coercion / pressure to use it?
6. What is the overall environmental context of the university / faculty?

Appendix I: Means and standard deviations for the 9 components

Means and standard deviation for the 9 components for the UT (n=34)

	Mean	Std. Deviation
Component 1, the new marketplace	-0.07	1.00
Component 2, the pedagogy for flexible learning	-0.11	0.93
Component 3, the technology for flexible learning	0.50	0.76
Component 4, students in a dynamic world	-0.11	1.10
Component 5, concrete vision	-0.03	0.84
Component 6, workplace demands for new forms of ICT in education	-0.39	0.86
Component 7, individualisation	-0.02	1.13
Component 8, cost-effectiveness	-0.08	0.90
Component 9, funding for support	-0.07	0.94

Means and standard deviation for the 9 components for the KUL (n=17)

Component 1, the new marketplace	Mean	Std. Deviation
Component 2, the pedagogy for flexible learning	0.26	0.94
Component 3, the technology for flexible learning	-0.16	1.03
Component 4, students in a dynamic world	-0.60	1.22
Component 5, concrete vision	-0.27	0.64
Component 6, workplace demands for new forms of ICT in education	0.57	0.93
Component 7, individualisation	0.06	1.09
Component 8, cost-effectiveness	0.03	1.06
Component 9, funding for support	-0.35	0.75

Means and standard deviation for the 9 components for the HUT (n=18)

	Mean	Std. Deviation
Component 1, the new marketplace	-0.24	0.97
Component 2, the pedagogy for flexible learning	0.30	1.14
Component 3, the technology for flexible learning	-0.37	0.87
Component 4, students in a dynamic world	0.19	1.04
Component 5, concrete vision	-0.21	1.14
Component 6, workplace demands for new forms of ICT in education	0.37	1.04
Component 7, individualisation	-0.21	0.86
Component 8, cost-effectiveness	0.52	1.38
Component 9, funding for support	0.06	1.11

Means and standard deviation for the 9 components for the LU (n=19)

	Mean	Std. Deviation
Component 1, the new marketplace	0.12	1.10
Component 2, the pedagogy for flexible learning	0.06	0.97
Component 3, the technology for flexible learning	-0.01	0.89
Component 4, students in a dynamic world	0.26	1.02
Component 5, concrete vision	-0.26	1.05
Component 6, workplace demands for new forms of ICT in education	0.30	0.92
Component 7, individualisation	0.20	0.83
Component 8, cost-effectiveness	-0.03	0.82
Component 9, funding for support	0.33	1.02

Means and standard deviation for the 9 components for the new universities (n=52)

	Mean	Std. Deviation
Component 1, the new marketplace	-0.13	0.98
Component 2, the pedagogy for flexible learning	0.03	1.02
Component 3, the technology for flexible learning	0.20	0.90
Component 4, students in a dynamic world	-0.01	1.08
Component 5, concrete vision	-0.09	0.95
Component 6, workplace demands for new forms of ICT in education	-0.13	0.99
Component 7, individualisation	-0.08	1.04
Component 8, cost-effectiveness	0.13	1.11
Component 9, funding for support	-0.02	0.99

Means and standard deviation for the 9 components for the old universities (n=36)

	Mean	Std. Deviation
Component 1, the new marketplace	0.19	1.01
Component 2, the pedagogy for flexible learning	-0.05	0.99
Component 3, the technology for flexible learning	-0.29	1.08
Component 4, students in a dynamic world	0.01	0.89
Component 5, concrete vision	0.13	1.07
Component 6, workplace demands for new forms of ICT in education	0.19	1.00
Component 7, individualisation	0.12	0.94
Component 8, cost-effectiveness	-0.18	0.79
Component 9, funding for support	0.04	1.02

Means and standard deviation for the 9 components for the Dutch-Flemish universities (n=51)

	Mean	Std. Deviation
Component 1, the new marketplace	0.04	0.98
Component 2, the pedagogy for flexible learning	-0.13	0.96
Component 3, the technology for flexible learning	0.14	1.06
Component 4, students in a dynamic world	-0.16	0.97
Component 5, concrete vision	0.17	0.91
Component 6, workplace demands for new forms of ICT in education	-0.24	0.96
Component 7, individualisation	0.00	1.10
Component 8, cost-effectiveness	-0.17	0.85
Component 9, funding for support	-0.14	0.94

Means and standard deviation for the 9 components for the Nordic universities (n=37)

	Mean	Std. Deviation
Component 1, the new marketplace	-0.05	1.04
Component 2, the pedagogy for flexible learning	0.18	1.05
Component 3, the technology for flexible learning	-0.19	0.89
Component 4, students in a dynamic world	0.23	1.01
Component 5, concrete vision	-0.24	1.08
Component 6, workplace demands for new forms of ICT in education	0.34	0.97
Component 7, individualisation	0.00	0.86
Component 8, cost-effectiveness	0.23	1.15
Component 9, funding for support	0.20	1.06

Means and standard deviation for the 9 components for the policy respondents (n=32)

	Mean	Std. Deviation
Component 1, the new marketplace	0.17	1.01
Component 2, the pedagogy for flexible learning	-0.22	0.87
Component 3, the technology for flexible learning	0.05	0.96
Component 4, students in a dynamic world	0.11	1.08
Component 5, concrete vision	-0.07	0.92
Component 6, workplace demands for new forms of ICT in education	0.33	1.10
Component 7, individualisation	-0.15	0.98
Component 8, cost-effectiveness	-0.08	0.86
Component 9, funding for support	-0.29	1.10

Means and standard deviation for the 9 components for the support respondents (n=32)

	Mean	Std. Deviation
Component 1, the new marketplace	0.04	1.05
Component 2, the pedagogy for flexible learning	0.09	1.06
Component 3, the technology for flexible learning	0.02	1.23
Component 4, students in a dynamic world	0.21	0.73
Component 5, concrete vision	0.08	1.17
Component 6, workplace demands for new forms of ICT in education	-0.21	0.99
Component 7, individualisation	-0.02	1.10
Component 8, cost-effectiveness	0.09	1.03
Component 9, funding for support	0.10	0.91

Means and standard deviation for the 9 components for the education respondents (n=24)

	Mean	Std. Deviation
Component 1, the new marketplace	-0.28	0.89
Component 2, the pedagogy for flexible learning	0.17	1.06
Component 3, the technology for flexible learning	-0.09	0.70
Component 4, students in a dynamic world	-0.43	1.11
Component 5, concrete vision	-0.01	0.88
Component 6, workplace demands for new forms of ICT in education	-0.17	0.78
Component 7, individualisation	0.23	0.88
Component 8, cost-effectiveness	-0.01	1.16
Component 9, funding for support	0.25	0.92

Appendix J: Results of the discriminant analysis: the 9 components by the four universities

Pooled Within-Groups correlation Matrix

	Comp. 1	Comp. 2	Comp. 3	Comp. 4	Comp. 5	Comp. 6	Comp. 7	Comp. 8	Comp. 9
Comp. 1	1.000	.019	.030	.014	-.035	-.004	-.017	.044	.007
Comp. 2	.019	1.000	.029	-.030	.035	-.045	.011	-.049	-.021
Comp. 3	.030	.029	1.000	.006	.065	.133	-.010	.016	-.016
Comp. 4	.014	-.030	.006	1.000	.056	-.050	-.002	-.044	-.041
Comp. 5	-.035	.035	.065	.056	1.000	.025	-.001	.065	.057
Comp. 6	-.004	-.045	.133	-.050	.025	1.000	.000	-.050	-.037
Comp. 7	-.017	.011	-.010	-.002	-.001	.000	1.000	.026	-.011
Comp. 8	.044	-.049	.016	-.044	.065	-.050	.026	1.000	-.028
Comp. 9	.007	-.021	-.016	-.041	.057	-.037	-.011	-.028	1.000

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.440	50.9	50.9	.553
2	.346	39.9	90.8	.507
3	.079	9.2	100.0	.271

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 3	.478	59.403	27	.000
2 through 3	.688	30.047	16	.018
3	.926	6.153	7	.522

Prior Probabilities for Groups

	Prior	Cases Used in Analysis	
Universiteit		Unweighted	Weighted
UT	.250	34	34.000
KUL	.250	17	17.000
HUT	.250	18	18.000
UL	.250	19	19.000
Total	1.000	88	88.000

Classification Results

			Predicted Group Membership				Total
		Universiteit	UT	KUL	HUT	UL	
Original	Count	UT	20	4	4	6	34
		KUL	5	9	1	2	17
		HUT	2	2	11	3	18
		UL	2	4	3	10	19
	%	UT	58.8	11.8	11.8	17.6	100.0
		KUL	29.4	52.9	5.9	11.8	100.0
		HUT	11.1	11.1	61.1	16.7	100.0
		UL	10.5	21.1	15.8	52.6	100.0