Knowledge Work Across Traditional Boundaries

a compilation of interviews

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– A compilation of interviews

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1 Introduction

This report is a compilation of ten interviews made with people active in three new Arenas. The report is intended for the International Evaluation Group connected to the strategic work at the University of Technology in Luleå (LTU). The collected data will be used in a future licentiate thesis. In this report however the material is not completely processed and analyzed. Therefore the report should be considered as a preliminary report containing empirical findings and an early analysis.

The University of Technology in Luleå (LTU), Sweden, has decided on a new strategy adapted to the complex and changeable environment. It has been concluded that it is no longer enough to strive for mastership within single disciplines; instead one must concentrate on learning for life. This will be implemented through the strategy where LTU becomes “The Creative University”. Up till today most of the work has been kept within disciplines. With the new strategy come directives to begin working across boundaries between disciplines but also student – teacher and university – surrounding society boundaries are expected to be crossed.

Four goal areas have been identified as most important in the new strategy. These are Knowledge Areas, Integrated knowledge Creation, Meeting Places and the University Culture. A Knowledge Area has its origin in an area with multifaceted and complex problems and is also often crossing boundaries (both between disciplines and between areas in the society). Within a Knowledge Area undergraduate education, research/postgraduate education, and co-operation with other sectors of society will occur and new knowledge will be created through the integrated creation of knowledge according to the strategy (University Board, 2000). This Integrated Creation of Knowledge is hoped to become one of the most important characteristics of LTU when the goal of becoming The Creative University has been reached. The environment of LTU is hoped to stimulate unexpected meetings at the same time as it supports the Knowledge Areas and the Integrated Knowledge Creation.

The implementation of the new strategy leads to new areas of education and research called Arenas. These Arenas are built by groups of people coming from different disciplines gathering around a common complex problem area. This problem area often

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1 When a knowledge area is taken in to operation and students can apply and be accepted, it is called an Arena.
gives the name to the Arena and this problem area is what the students and researchers will study. New working groups will be implemented through the new strategy at LTU. These groups will be boundary crossing in the sense that different disciplines and perspectives will be cooperating around shared problem areas. The fact that these new groups work in partnership in a logical, not physical, organization leads to questions about how they organize their work: how do they communicate and interact, and where; how do they meet physically, mentally and virtually, and for what purposes. The development of the Arenas can be viewed as an innovation project.

There is little understanding today of how organizations create and manage knowledge dynamically. One of the most famous and prominent people within this area is Ikujiro Nonaka. Nonaka and his associates have during the last decade been exploring this area (1994; 1995; 1998; 2000; 2003). Nonaka & Konno (1998) ask questions as “what are the fundamental conditions for knowledge creation”, “where is knowledge creation located” and “is it possible to actually manage knowledge like other resources”. As an answer to these questions they introduce the Japanese concept of Ba, which they say can be translated into the English word place. Ba is a metaphor for a shared context. Shared contexts help a group to communicate, cooperate and share knowledge in a successful way. My questions are related to the creation of shared context in boundary crossing knowledge work. Therefore questions of interaction and communication are focused.

The purpose with this report is to give illustrative examples of new boundary crossing groups in order to develop our knowledge of how to design for knowledge work. Through the understanding of what experiences people who work in boundary-crossing groups meet when they interact and communicate and in this way create a shared context important input to which issues to consider when we design or chose systems for boundary-crossing knowledge work will be given. The systems I focus on are human activity systems (Checkland 1981) and their supporting systems, i.e. information systems in Checkland’s vocabulary.
After this short introduction with a background to the report I will continue with strategies for data collection and analysis. As a part of this some reflections on my research are given. This is followed by a presentation of the results from the vertical analysis of the interviews. This is given in the three themes meeting places, integrated knowledge creation and culture. To each part a horizontal analysis of the results is given in a comparative summary. Finally I conclude with a discussion of the results.
2 Methodological Strategy
This chapter will give a picture of the strategic choices I have made and why these strategies have been chosen.

2.1 Strategies for Interviews and Sample Selection
Depending on what aim you have with your interviews there are different approaches to choose according to Patel & Davidson (1994). Two important aspects need to be considered during the planning phase. To what extent the interviews should be standardized and structured. In my study I have used a low degree of structure while the degree of standardization has been somewhat higher. This means that I have prepared a number of questions\(^2\) that I wanted to find answers to. I was however trying to be open for the respondent and to adapt to what was said and thereby let the respondent talk freely around the themes in the interview.

The preparations included choosing of themes and questions as well as methods for analysis. An interview guide was prepared with a number of themes and to each theme a number of questions on a level of more detail were posed. The themes chosen are related to the goal areas within The Creative University. These themes are also important areas in the literature of knowledge management and related to knowledge work. The first theme in the interview guide was meeting places, the second integrated knowledge creation and the third culture. Within each theme the questions focused on both what is general and on what is specific for the respondent. This means that for example, questions related to the respondents individual experience of meetings within the group as well as the view on meetings held collectively among active people in the Arenas will be asked about. In relation to these themes the questions were also focusing on hindrances and facilitators of interaction and communication within the group. The answers to these questions can be used to give a picture of how the creation of a shared context is supported.

\(^2\) See Appendix 1
It is the building of a shared context for integrated knowledge creation I am interested in and therefore I wanted to study newly formed groups. Moreover it had to be groups’ working across boundaries since that is also what I am focusing on. This was found at LTU within the Arenas. The Arenas I have chosen to study are all focusing on different complex problem areas and have been given their names from this. They are “Lifestyle, Health and Technology”, “Innovative Technology and Enterprise” and ”Global Resources”.

2.2 Strategy for Analysis

In this section I will give a short description of my strategies for analyzing the data. Since systems thinking is a central way of thinking for me epistemologically it will also be central in my analysis of data. Systems thinking is focused on understanding the world in terms of wholes, relations, functions and context. It emphasizes how everything is connected and moves jointly.

Lundahl & Öqvist (2002) argue that systems theory is interested in how the reality reveals itself and not on how it really is. I see this statement as a way of saying that reality is socially constructed and individually interpreted. Lundahl & Öqvist relates this to the law of parsimony, according to which things simply fall into place in a way that gives a comfortable and pleasant feeling.

The soft systems approach is closely related to the hermeneutic approach. In the hermeneutic tradition the researcher approach the object under study subjectively. Pre-knowledge, thoughts and feelings are seen as an asset in the interpretation and understanding. The researcher puts the whole in relation to the parts and takes turns between part and whole in order to get a rich understanding as possible of the studied. When a text is studied (e.g. a transcript of an interview) it is first read through all together to get an understanding for the whole. After this different parts can be read to get a closer understanding of these. This is called the hermeneutic spiral (Ödman 1979). This is how I have handled my data. In this way I have gained a picture of the whole as well as of the parts.
I have used a strategy of reflexive systematic analysis in which first a vertical and thereafter a horizontal analysis is made (Thomsson 2002). The vertical analysis is presented in chapter three and the horizontal analysis is presented as a summary to each part of the chapter. The results have been grouped into the three areas from the interview guide and within each group into subgroups which have appeared through the analysis of the transcripts from the interviews.

2.3 Reflecting on My Strategies

Concepts that usually are used in the considerations of trustworthiness of research belong to the history of such research that uses quantitative methods for collection and analysis of data. This has led to a focus on problems of measurement. The two concepts for measurements used most often are validity and reliability, i.e. what is measured and how reliable is the measurement tool. Patel and Tebelius (1987) argue for four other concepts to elucidate the scientific problems that are concerned. These concepts can be applied to both quantitative and qualitative research. The concepts are relevancy, conformity, trustworthiness and accuracy. I will use these four concepts to reflect on my research process since they in a better way elucidate important questions in my research than the concepts of validity and reliability do. In the coming sections I give some reflections on these concepts in relation to my research.

2.3.1 Relevancy

The relevancy concept is related to choice of data collection method and sample selection. Patel & Tebelius (1987) argue that the choice of respondents and methods for information retrieval should be made systemically and after pre-decided criteria in qualitative research. This is because one aims for diversified information of the phenomenon (a rich picture). I made a strategic choice from people active in these Arenas, i.e. I have chosen to interview people with different roles in the work, people

3 (My translation) in Swedish the concepts are: tillämplighet, överensstämmelse, pålitlighet och noggrannhet.
representing different disciplines and coming from different campuses in order to get a rich picture from many perspectives, indicating a higher level of relevancy

2.3.2 Conformity
When it comes to the level of reasonableness of the analysis of the collected data in qualitative research it is considered to be higher if the researcher can show that the interpretations are applicable to different situations and that the interpretations are grounded on a rich material. In my case the conformity has been achieved through three different cases and also through a rich material. The method of analysis is also to take turns between the whole and the parts of the material, which helps the level of conformity to be higher.

2.3.3 Trustworthiness
One important issue to discuss is the fact that I am doing research on the same organization (LTU) where I am accepted as a PhD student. This can lead to different difficulties. To hold a distance and to be unbiased is mentioned as problems in the literature (Repstad 1999). This is however not an argument for not performing research in a familiar environment. It is though something to keep in mind during the research. This is because it is not only I who can be affected but also my respondents can be biased by the fact that we are employed at the university. But it can also be a motivation to do research on an area, which is known, if my results can affect the working environment in a positive way. Also my pre-knowledge of the environment may be helpful in my study. But there are of course two sides of all of these questions.

Questions on anonymity and confidentiality are important to handle. To handle these issues I have informed the respondents that all material will be handled confidentially and that I am the only person that will have access to the data. The material is presented in a condensed way where no names or persons are pointed out. Only one of the respondents has had questions about this. My plan for how to handle this seemed to satisfy the respondent. The results are presented in themes handling important issues related to the

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4 Hypothetically, it can be possible that people within the organization can identify colleagues but in a larger perspective I do not expect that any of the respondents will be possible to identify.
questions concerned with knowledge work. But since I make comparisons between three Arenas it is clear what differences and similarities I have found among them. The trustworthiness of my research is affected by the willingness of my respondents to give trustworthy information. I have during the interviews felt that all respondents have been honest and open in their answers. They have been willing to give examples and to talk about their experiences. There are no questions that they didn’t want to answer. Therefore I feel that I have a rich material reflecting the experiences from the ten respondents.

Ideally, to get a rich picture one should be able to record the interviews and to transcript them afterwards. Then one would not be distracted from the conversation by having to take notes. This strategy has been used in nine of the interviews. My strategy was to create a trustful situation and also to be sure to be able to catch all that is said during these meetings. This also made it possible for me to focus on the respondent and listen more actively to the answers and through that follow up with related questions. Each interview has taken between 40 minutes to 2 ½ hours. These interviews have been taped and transcribed, and the transcriptions have been used for the compilation and analysis. Unfortunately, I had technical problems in two of the interviews and from these interviews I have written notes from memory. A compensation for this is that all respondents are given a chance to read and comment the report. I have sent the report to all respondents and asked for comments on the contents of the report. The report was sent to them on October 28 asking for a response before November 10, today it is November 14 and I have not received any comments.

2.3.4 Accuracy
The question of accuracy is related to honesty and conscientiousness in my research. This is especially important in the analysis and presentation of data. The process of analysis and interpretations should be thoroughly presented. This is one reason for the lengthy chapter on methodological strategy. I also give the respondents a possibility to read what

5 First I had a meeting with one contact person for one of the Arenas to be able to identify relevant respondents. To this meeting no tape recorder was brought but the interview questions were and the conversation turned out to be much like an interview. Directly after this meeting I made notes from memory and I have used these in this report since this was very revealing.
I have written and a chance to comment and to verify if my interpretations as a way to confirm my honesty and conscientiousness.

2.3.5 Comments from Respondents
The report was sent to all respondents on October 28 with mail. A note\(^6\) was added to the report. On this note I asked/offered the respondents to read the report to verify or correct misunderstandings or faults in the report in correlation to what I had said when we met for the interviews. A reminder on this was also sent out on November 14 since no comments had arrived. After this reminder I have received comments from seven of the respondents. Four of these verify my interpretations without any further comments and say that the report gives a good and clear picture of what was said during the interview. The other three who have commented the report agree with the first four but they also have some comments.

The comments on a level of detail have led to a change in some sentences to clarify what was meant. Also spelling errors have been corrected. One comment was related to the number of interviews and that they could be too few if I wanted to relate the results to different roles, disciplines etc. Therefore I want to clarify that my aim has been to interview people from different disciplines, campuses and so on to learn about the work across boundaries. The comparisons I want to make are between the three Arenas and, thus, not between disciplines, roles etc. Since the purpose with this report is to give illustrative examples of new boundary crossing groups in order to develop our knowledge of how to design for knowledge work my questions are related to the creation of shared context in boundary crossing knowledge work.

A second comment was that the four goal areas could have been explained in more detail in the introduction. I have chosen not to do this since the report is intended for the international evaluation group who are well aware of these goal areas. I will however keep this in mind for other forums.

\(^6\) See appendix 2
One last comment from one of the respondents was that I in this report compare Arenas with undergraduate programs, i.e. that I equalise them. The respondent wants to emphasise that Arenas consist of undergraduate education, research and research schools and I agree on this, i.e. that an Arena consist of these parts. I have therefore made some clarifying changes in the report. This is a confusing area though and I believe that one reason for this is that the knowledge areas becomes Arenas when they begin accepting students to the undergraduate education, and therefore the arena is seen as an undergraduate program. Moreover, when searching the LTU webpage or intranet the information found is mostly about the arenas in the role as undergraduate educations. It is thus difficult to find general information of the Arenas. This is the reason for the presentation of the three Arenas as educational programs in the introduction of chapter three.

The reason for much focus on the undergraduate educations in this report however is that it reflects what the respondents talked about during the interviews while much of my interview questions focused the work, communication and interaction within the Arena or in subgroups of the Arena. This shows that the work with the undergraduate education have been much in focus for the respondents during the last year. I believe that this is an important question to handle for the university and maybe some work is needed to build a shared mental model of what an Arena really is. Also the marketing of the Arenas need to show more than undergraduate programs.
3 Results
This chapter begins with a presentation of the results from the vertical analysis of the interviews. This will be done in four parts, meeting places, integrated knowledge creation, culture and hindrances and facilitators. The results will be quite rich in that much of what I have found out in the interviews is presented. This is because I want to show the richness of data I have gained. I will show how they work, communicate and interact, what is common and what stands out in the results. Each part is concluded with a horizontal analysis where the three Arenas are compared with each other. Here I will shortly describe how the results from the three Arenas in some ways are identical, in some ways close and in some ways very different from each others.

3.1 Three Arenas
According to information on the LTU webpage Arena Lifestyle, Health and Technology (LHT)\(^7\) is an educational program for people interested in areas such as technical issues in healthcare and rehabilitation work. Moreover, the levels of welfare in society, the affect buildings have on our health or how different working or private activities in cold climate affects us are examples of interest areas in this Arena. Arena Innovative Technology and Enterprise (ITE)\(^8\) is described as an educational program for people interested in how new technological solutions can be developed, used and commercialized or in how learning in this area occurs. Arena Global Resources (GR)\(^9\) is outlined as an educational program for the student interested in how to build a sustainable society and how to be economical with resources. These issues are reflected on from technical, political, economical and legal aspects. In all three Arenas undergraduate education, research and research schools focus these issues.

3.2 Meeting Places
The university is a meeting place for the integrated growth of knowledge. The mutual exchange of experiences is fundamental to the growth of new knowledge. By creating environments and forms of interaction that encourage contact between persons from different subject area, unexpected knowledge can occur. In the same way, the virtual campus will support the integrated growth of knowledge by connecting together the network between students, teachers, researchers and the

\(^7\) Information from the university webpage, http://ugglan.adm.luth.se/pdf/printpugglans.pdf?progr=ARLHT
\(^8\) Information from the university webpage, http://ugglan.adm.luth.se/program.php?progr=ARITF&lang=swe&orgpage=lista_Arena
\(^9\) Information from the university webpage, http://ugglan.adm.luth.se/program.php?progr=ARJOR&lang=swe&orgpage=lista_Arena
the non-academic world, and by helping them to develop. The forms of interaction will stimulate creative thinking, and provide space for reflection and analysis.

Below the results of the interviews in relation to meeting places are presented in the order of physical meetings (face to face), virtual meetings (mail, web) and mental meetings (shared concepts, shared mental models).

### 3.2.1 Arena Lifestyle, Health and Technology

In the beginning of the development work of Arena LHT an open workshop was arranged. At this meeting anybody who wanted could participate and contribute to the development of the Arena. At this meeting lists were made and those who wanted to participate in the development of the Arena signed up. Five sectors\(^{10}\) were formed and these can be viewed as meeting places for both employees (teachers/researchers) and students. The employees are active in sectors connected to their area of interest and the students are supposed to choose one sector to niche their studies and to take part in research projects within one sector.

Other meeting places within the Arena are the different groups that are working within the Arena. Examples are the student council, the working committee, the steering group and the Arena council. In the work of these groups, the content of the Arena and also practical matters are discussed at meetings. The different campuses have taken turns as hosts for the meetings. In this way everybody has had to travel to meetings instead of making the same persons travel each time. Employees from the campuses in Boden, Luleå and Skellefteå are active in Arena LHT. Most of the meetings are planned with different time spans but also spontaneous meetings have been possible after a phone call. One of the respondents describes the work with meetings in small groups where they have discussed and developed ideas which later has been presented in larger groups.

The creation of meeting places for students across boundaries is one matter that has been thoroughly discussed. It has been decided to let the students integrate and meet other students at already existing meeting places at the university and in courses given together.

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\(^{10}\) The five sectors are; “Technology, healthcare, care and rehabilitation”, “Construction and environment”, “A good life”, “The good work” and “Climate and leisure time”. (my translations)
with other students from other programs. To handle the internal communication among
the Arena students a special notice board and post-boxes has been placed at the institution
of health science. Last year a meeting for students as well as employees was arranged
when people from the national institute for working life came for half a day and
discussed technology and health in combination. This was a very valuable type of
meeting place. One of the respondents describes plans for the arrangement of one Arena
day during the autumn (2003) where students from the first and second year meet with
teachers, researchers and external people. During the day the participants will be divided
into different groups and meet and discuss public health issues from different
perspectives during a whole day.

The respondents say that they use e-mail and telephone as complements to the face to
face meetings and that no other virtual meeting place is used. One of the respondents
argues that they haven’t used the possibility to have virtual meetings since they
themselves are not familiar with the technique and are not aware of the possibilities. The
respondent says that we must learn to use this in our everyday work and not see it as
exceptions from the regular work. Moreover this respondent argues from earlier
experiences from virtual meetings that there are always technical problems and that this
is one reason for avoiding virtual meetings today. Therefore the technology must become
so simple and reliable to use that no time is wasted on technical problems but instead
used for the issues of the planned meeting. Moreover, one of the respondents say that the
growth of the Arena has been a long process and during this phase of the Arenas lifetime
it has not felt suitable to have virtual meetings, rather it has been necessary to have face
to face meetings. In this way the group has been able to show each others sketches of
ideas and to be able to penetrate the ideas in deeper discussions.

The Arena has a webpage which can be viewed as a virtual meeting place. Here
documents concerning the Arena are published and both students and employees can
access this page to find information. However, my impression is that this page is not used
to any higher degree. My impression is based on the fact that it is only one respondent
that mentions the webpage. The respondents say that if the webpage could be used more
the information and knowledge would flow much more effectively within the Arena. The only group that seems to visit the webpage somewhat regularly is the student group, according to the respondent. The need for a forum for meetings both physically and virtually is mentioned by one of the respondents. Two of the respondents believe that it is necessary to find a balance between physical and virtual meetings and to find the way to use each type in an effective way. The process of creating the virtual campus is though something that one of the respondents wants the university to push. It is not in the role of an Arena to push the development of the virtual campus.

During the process many discussions on knowledge creation and pedagogical issues have taken place in a smaller group. Articles and books on these issues have been read and discussed and related to the vision of the creative university. In this way the group has been able to build shared mental models. This has been an active and conscious way of working. It is always difficult to build something new, to make it work and time pressure and long distances between campuses are two of the conditions which are mentioned as examples that make it difficult to work in ways that support the building of trust, engagement and shared mental models. One difficulty has been to view things from the new Arena perspective, i.e. to see which “health knowledge” would be beneficial for an engineer or which “technology knowledge” would be beneficial for a nurse. Which of this would a future employer like the employee to possess? They were able to answer some of these questions after the field study made by the students.

3.2.2 Arena Innovative Technology and Enterprise
The work with the development of Arena ITE started with an open workshop. This was followed by several meetings where the Arena developed into an idea of how to combine technology and business. The work within the Arena is handled in a number of groups. In the Arena council internal and external people meet together with student representatives. There is also a student council in which the students can take part of the development of the Arena. The steering group in the Arena have three coordinators who come from three different departments and three other members with different roles. All members have defined roles and are responsible for different areas. Moreover, a group of three is
heading the research school and people in charge of greenhouses are also taking part in the work within the Arena.

The people active in the steering group is a mixture of people from many different disciplines. It has been a strategy to create a mixture of people with different views, knowledge and organisational belonging. The communication within the group is described as open and prestige less. The respondents argue of the importance of meeting face to face. Therefore the work within the Arena is to a large extent handled with personal meetings. The steering group have planned meetings approximately every tenth day. As the group has grown and the work has evolved the structure of the meetings also has developed. In the beginning the meetings were quite unstructured but today an agenda is always prepared on beforehand.

One of the respondents says that there is a flow in the meetings which gives them a feeling of having powerful meetings. They give and take and have discussions about the content of the Arena, about practical matters and about strategic matters. At some of the meetings people responsible for the greenhouses participate and this is a way to give and take knowledge from the practical point, how is the greenhouse working in reality. How can changes be made in order to make it work in better ways.

Meetings has been held at many places at the campus in Luleå but most often the meetings have been held in one particular room which by one of the respondents is described as a very important room since it holds memories of when ideas or breakthroughs came in their work. This meeting room has the feeling of a home room where everything important has happened. In this room different occasions can be visualised in memory according to one of the respondents. When the idea of greenhouses had become the pedagogical way to reach knowledge creation the group asked people to give ideas for different greenhouses. They received a number of ideas for greenhouses and four of them were chosen. The Arena council was one important meeting place used for a dialogue about the greenhouses and as a way to find out what kind of competences future employers would like the students to possess.
In the discussions about places where students build their knowledge an idea of a meeting place in the E-house is mentioned by two of the respondents who describe the ideas of a place where students, teachers and researchers can meet. The idea is that both large and smaller project rooms are available for work. Computers and telephones are available so the students can manage their projects. Smaller and larger classrooms are close as well as a café. On the second floor teachers and researchers have their offices and are in this way close to the activities. It must be possible to work alone or in groups depending on the assignment. The idea is that this meeting place should have a central position in the house. This is also one reason for not giving the students a home classroom, it is not a classroom that is the vision but a meeting place according to one respondent.

As a complement to the personal meetings email and telephone has been used according to the respondents. No other virtual meeting places have been used. One of the reasons for this is that the group have felt that it is necessary to meet in person. One of the respondents is even against the idea of using virtual meetings in the group. This would take the sparkle of the work away is the argument. To be able to meet in person and to inspire each other and to work together is very important according to the respondent. The group have decided though to look into what possible IT support that is available to support the work in the group. A project system which can handle documents, mail, calendar and meetings is the idea. In a system like this a collected documentation is possible and this is very important according to one of the respondents. Moreover this type of system could be a complement to the physical meetings according to the respondent.

A virtual meeting place for project work for the students is being planned for. The group has begun searching for a learning management system (LMS) for the students. As a part of this an electronic portfolio will be used as a means to save work as a history on what has been done in the greenhouses. The LMS should be used for examination, reporting on projects and as a tool for handling documents and internal communication for the student group. The work with the concept of greenhouses has to a large extent been handled on
the email. A first document was written and this has been sent out on mail and people have read and reflected on the document and written comments and ideas to the first draft. In this way the idea of greenhouses was developed asynchronically. In parallel to this process the concept was also handled at their regular meetings, but one respondent say that this development would have been impossible without email.

Through the regular meetings and the work with the document describing greenhouses the group have developed a strong shared picture of the core vision of the Arena. The idea of greenhouses has given the Arena ITE a mental model to work with. This is their shared model of how to work with integrated knowledge creation. At all meetings this model is used as an object towards all ideas are tried. It has given the group a strong picture which they share with each other. Much time has been spent on this idea and the fact that they have developed this idea has made the work very effective. The model makes it possible for the many disciplines to meet in different projects. The model has also helped in the work of sorting out what belongs and what falls outside the Arena.

3.2.3 Arena Global Resources

Arena GR is organized in a number of working groups. Each group can be viewed as a meeting place. The Arena is divided into nine exam areas\textsuperscript{11} which have representatives in the undergraduate education group, the research school group and in the Arena council. The undergraduate education group consists of several sub groups, the steering group, the undergraduate group, one group for the first semester, one recruitment group and one academic advisor.

\textsuperscript{11} The nine areas for exam are; Land- and water resources (Land- och vattenresurser), Environmental informatics (miljöinformatik), Environment- and quality management (miljö- och kvalitetsmanagement), Technology for environmental control (miljövårdande teknik), Politics and law for energy and use of natures resources (politiik och juridik för energi och naturresursanvändning), Sustainable energy systems (uthålliga energisystem), Sustainable raw-material provision (uthållig råvaruförsörjning), Sustainable transportation systems (uthålliga transportsystem), Environmental engineering (samhällsbyggnadsteknik). (my translations)
The work in these groups is based on personal meetings. In the Arena large open meetings has been used to a large extent, especially in the beginning of the process of creating the Arena. The meetings are described by the respondents as large forums for discussion to which anybody interested was welcome to participate in. During these meetings the nine exam areas were identified and named. This gave the Arena a structure to proceed from and to start designing the undergraduate education. One of the respondents says that large meetings still is being used in different forums, for example discussions on new possible ways of examination. In these meetings they share experiences and ideas on how to design courses which enable deep learning. Smaller meetings are also usual in all the sub-groups. The meetings are described as traditional meetings with an agenda and someone taking notes. Many of the meetings have been held in the same meeting room.

A shared meeting place has also been created for the students. They have been given a large room in which they have lessons in the front of the room and in the back of the room they have created their own meeting place where they meet both socially and studying. This room is now given to the new first year students so they can create their own meeting place and the second year students have been given another smaller room. During the first semester a study trip was arranged where the students visited different places and met people working with issues connected to global resources. The students meet and read the whole first semester together and then each year in one Arena specific course. The courses during year two – four will be led by PhD students from the research school and this makes these courses a meeting place for the both student groups.

Complements to the personal meetings among people working in Arena GR are email and telephone. No other virtual meeting places have been used. The email has mostly been used to spread information and the respondents say that it has worked well most of the time. Arena GR have one webpage which could function as a virtual meeting place but it doesn’t seem to do that today. One of the respondents says that there is a need for a shared virtual space where information is gathered in one place, for example information for the students when they choose between different courses. One of the other
respondents says that all Arenas have one webpage and they all look different, and are seldom updated. The webpage for Arena GR suffers from this, and it has been decided to invest in a new webpage for the Arena. It is hoped that the new webpage will become a new virtual meeting place. The first part has just been finished and the rest will be developed during the autumn. Still, the respondent suggests that the building of virtual meeting places should be a question for the whole university and should not be handled by the Arenas.

The work with finding the core of the Arena was to a large extent made at the large meetings during the first year. This work ended up in the nine exam areas in which the work has continued. Much work has been made to coordinate the first semester. The semester is divided into four courses and each course has been divided into themes in which different disciplines meet. One of the respondents says that it has not been difficult to work together since they have a shared view on science, but also that they haven’t had any discussions on what the core in each theme is. Each teacher has their own view. To further develop the first semester it has been documented in a summary where a short description of each lesson is given. This has given the teachers an insight in each others work and this has also opened up for new ways to make the connections between the parts clearer for both students and for themselves. For example has this document made teachers aware of when they use the same concepts and this has led to discussions on how the concept is approached and further development in the courses has been possible.

3.2.4 Comparative Summary of Meeting Places

Physical meetings are the outstanding most used way to meet in all three Arenas. In the beginning of each Arena open workshops has been used as a way to find interested people and as a way to form the contents of the Arena. Arena global resources still use this type of meetings on some occasions. But today smaller meetings in different subgroups are the most common way of meeting. Each Arena consists of a number of subgroups. Arena global resources have most and Arena innovative technology and enterprise have the least number of subgroups.
Many of the respondents emphasise the importance of having personal meetings for different reasons. The meetings in subgroups are a way of socializing and in this way building an understanding of each others and of the shared ideas of the Arena. This process is best handled in face to face meetings.

The chosen meeting places differ somewhat between the Arenas. LHT has chosen to use varied meeting places and take turns in travelling. While ITE and GR has varied meeting places sometimes but most often has used the same meeting room. In ITE this is described as important since the meeting room holds memories of breakthroughs in work. Other meeting places that are mentioned as important for the work are the knowledge creation course for teachers, the leadership program and also the coordinators meetings. At these meetings they have met others from many disciplines and they have discussed knowledge creation, pedagogical questions and they have also been able to identify others that could be important for the work in the Arena. In Arena global recourses they have arranged open seminars where teachers’ experiences have been discussed and shared, pedagogical questions and new ways to examination for example.

When it comes to meeting places for the students this has been tackled in different ways. In LHT they have arranged seminars for students as part of their studies. They have also arranged thematical days where external participants have attended. The students have a special notice board and post-boxes for the students. The webpage is also mentioned to be used by the students. In Arena GR the students have been on a study trip during their first semester and a classroom of their own. While Arena ITE use the greenhouses as example for meeting place for the students.

In our talk about virtual meetings all respondents first say that no virtual meeting places have been used and then continue to say that E-mail and telephone have been used as complements to the personal meetings. Mostly to spread information but in Arena ITE it has been used to formulate the core idea of the Arena. The respondents say that this would have been impossible without the use of the asynchronically virtual discussion. When it comes to the use of virtual media one of the respondents have had bad
experiences from before while others say that they are not aware of which possibilities there are. Two respondents, one from Arena GR and one from Arena ITE, say that the development of this should be a question for the whole university. However, Arena GR is investing in a new dynamic webpage as a new virtual meeting place for people within the Arena and Arena ITE are searching for possible systems to use. Within all three Arenas there are ideas on systems that they or their students could use in their work.

Frequent physical interaction and perception help people to create shared mental models and routines which can be seen as mental meetings. In all Arenas they have had many open discussions as a way to find the core of the Arena. The creation of a shared mental model has been done in an active and conscious way in Arena LHT through the three concepts lifestyle, health and technology. In Arena ITE the greenhouse concept has been used and in Arena GR the summary of the first semester in which all exam areas were represented has helped the participants to build the shared mental model of what the core of the Arena is.

All three Arenas have used similar strategies and the process is in some ways identical between the Arenas. The largest difference lays in the choice of meeting places, i.e. to use the same place or to take turns. Also the use of email is different between the Arenas and here Arena ITE stands out. This use has also led to a very strong shared mental model of the Arena.

3.3 Integrated Knowledge Creation

The main characteristic of Luleå University of Technology is the integrated growth of knowledge. The growth of knowledge involves a form of learning that is science-based, related to the individual's choice and circumstances, and with clear integration of research and education. The learning is a process in which students, teachers and researchers, and the surrounding society actively participate. Review of both form and content is an important element in developing the learning process. The University 2006, p 16, (2000)

3.3.1 Arena Lifestyle, Health and Technology

In the interviews most of the conversation was focused on the knowledge creation among students. This is because they haven’t been able to or rather have had time to focus on
their own knowledge creation according to the respondents. All efforts have been focused on getting the program started and that courses and administrative issues can be handled. But in the interviews talking about how the groups had worked it was stated that knowledge creation had taken place in the groups even though no strategy for this had been discussed.

The knowledge creation among the employees active in the Arena has taken place during the meetings in different groups. The many discussions have helped the involved to create engagement and a shared mental model of the Arena. One of the respondents says that they learn and build knowledge all the time through a continuous interaction and discussion in which they exchange experiences and thoughts. However they have not worked out a strategy for how to spread and share knowledge in the groups. The work across disciplinary boundaries has led to individual knowledge creation where the involved people have gained knowledge about other disciplines. But also about the three concepts that are in focus in the Arena, how they connect to each other and how the areas can influence each other. It has also led to the identification of possible interdisciplinary research projects.

Much focus has been on the strategy for the students’ knowledge creation. One of the respondents says that the most important part of this work with the Arena is that the focus has been changed from teaching to learning. This has led to strategies for deep-learning instead of surface-learning being implemented. For each of the first three years Arena LHT starts up the first semester with Arena specific courses. The first half of the semester is divided into two courses where the first one is focused on knowledge creation. The second part is a course where the students take part of a research project within one of the five sectors. Thereafter the courses for each year are made by choice by the student according to interest and planned exam.

The focus on the Arena specific courses derives from the three concepts health, lifestyle and technology. These concepts have been the framework from which the work has developed. The students start to build a knowledge portfolio in which they collect all
experiences and reflections and knowledge they gain during the education. Another example is when the students from the perspective of their future exam should examine in what ways the three concepts would become useful. An inquiry was made into what is wanted on the work market. The study was presented at a seminar where the inquiring group gave a presentation on the results and a supporting group gave response on this in constructive questions and comments. This was followed by questions and comments from the auditory. After the seminar the students continued their field study and finally a seminar was held where all 40 students gave a presentation of their results. This is a good example of knowledge creation and a way to share and build knowledge within a course.

On some occasions external lecturers have visited and different themes have been explored from different perspectives as a way to build integrated knowledge. During the courses students are encouraged to work in different group constellations as a means to learn from many perspectives and to enrich their learning in this way. The students are also encouraged to reflect on their own learning.

3.3.2 Arena Innovative Technology and Enterprise

The ways knowledge is created in the Arena has been discussed on different levels. Most of this has been focused on student’s knowledge creation and the greenhouses. The respondents say that reflections have been made on how their own knowledge within the group has developed during the working process but that this has not been made in a conscious or structured way. One of the respondents emphasizes the importance of creating trust within the group right from the start and that this process has been the base for their knowledge creation.

As a whole the greenhouses is the place where knowledge creation is operationalised in Arena ITE. The idea is that people from a number of disciplines meet in development and/or research projects. In all greenhouses interdisciplinary development/research is the core; however the technical/business focus differs in extent between the greenhouses. Participants are undergraduate students, research students, researchers and representatives from business or industry. In the greenhouse all participants take a role in the project and
from this role they learn, this is the way knowledge is created. One of the pedagogical ideas with this is that the student is trained in a professional role. Usually the university gives the student tools to use in the future work, but no training for the future role. In this way both tools and training in the role is given. It is an activity oriented knowledge creation which the respondents believe will make the students attractive on the work market.

There have been discussions on using portfolios in which the student collect work samples which can have the function as complements to the grades. Moreover the students are expected to continuously reflect on their own knowledge creation. The idea to collect students in greenhouses has been a facilitator in many ways. It has helped the respondents to lift their thinking from technology or business and how to mix these in a good way. The participants in the project use and learn what is necessary for the project; they also learn that technology and business need each other in an innovative project. One of the respondents says that when they realized that it was the way of meeting in these projects that was important for knowledge creation that the idea of greenhouses came forward.

3.3.3 Arena Global Resources
The work within the group developing the first semester is focused on pedagogical issues and knowledge creation among students. Knowledge creation among employees is the second focus in this work. As part of this work the teachers’ attitudes and views on learning has been discussed at different meetings. Moreover, the first semester has been developed and coordinated in a better way to offer possibilities for deep learning among the students. The best possibilities for employees to create knowledge are according to the respondents the new possibilities with large multi disciplinary research projects which the Arena enables.

In Arena GR many professors are active in teaching on the first year level and compared to other courses this is not usually the case. This has been appreciated by the students and even though many lecturers have been active in the first semester it has not been
experienced as consisting of short pieces with no connection to each other by the students. This was one of the worries before the first cycle of courses according to two of the respondents. The undergraduate education has become quite specialized as the professors are teaching from their research focus.

The students are encouraged to reflect on their learning both in the classroom situations but also in examinations where the questions may be of the type that there is no answer in the literature, but rather that the student must understand and be able to apply the understanding to a new area. They have also focused on important capabilities that the student will need during their whole period as students but also later in their work. These capabilities are for example to be able to express themselves both in written and oral presentations, to work with the computer and study technique. Moreover, they have worked with teambuilding among the students as a way to learn to cooperate which is an important capability says one of the respondents. The respondent also says that this has led to a sense of security within the group and that this is a prerequisite for knowledge creation.

3.3.4 Comparative Summary of Integrated Knowledge Creation

Knowledge creation starts with socialization. This is also something that the members of all three Arenas have done through the use of personal face to face meetings. In all three Arenas the respondents also say that they know that they have created new knowledge but that they have not had any strategy for this, all their efforts has been on the students’ knowledge creation. In Arena ITE the creation of trust from the beginning is seen as the base for the work. The new multi disciplinary research projects are given as examples for places for employees to create knowledge in Arena GR. They have also arranged seminars where experiences and ideas have been shared. Knowledge has been created through the synthesis of contradictions in these discussions.

The design of the undergraduate courses has been facilitated by the knowledge creation course for teachers. This is mentioned in Arena LHT and GR. There are many similarities between the design of the undergraduate courses and ideas of knowledge creation for the
students between the Arenas. One clear difference though is that Arena LHT and GR give a course focusing on knowledge creation while Arena ITE views the greenhouses as the place for this. A knowledge portfolio is used in Arena LHT and ITE but is not mentioned in Arena GR. Continuous reflections is a requisite for all students in all Arenas. They are asked to reflect on their own learning and knowledge creation.

In Arena LHT they have arranged a number of seminars, thematical days and encouraged the students to work in different groups as a way to stimulate learning and knowledge creation. While teambuilding and other important capabilities such as insights on how they learn, cooperate as well as how to write and present has been focused in Arena GR. One other important aspect is that all three Arenas in some way lets the students have an idea of their role in their future working life. Arena ITE takes this the furthest through the work in greenhouses where all participants chose one role and learn within the role. In Arena LHT all students have made an inquiry into future roles in work and in Arena GR they have made study visits in different future work environments. One of the respondents in Arena LHT emphasise the change in focus from teaching to learning as the most positive aspect of the courses within the undergraduate courses in the Arena. In Arena GR the large amount of professors teaching at first year courses is viewed as something extra.

All three Arenas have had similar strategies and the process is in some ways identical between the Arenas. The largest differences lay in the design of knowledge creation course for the students. I find it interesting that none of the Arenas have used the strategic and conscious design of knowledge creation in their own work.

3.4 Culture
The workings of Luleå University of Technology will be permeated with openness, trust and transparency, as well as a real interest in development and creativity. The culture will also be characterised by a spirit of enterprise where risk-taking and failing are allowed; an atmosphere that is characterised by confidence in the individual. The University 2006, p 24, (2000)
3.4.1 Arena Lifestyle, Health and Technology

Three of the respondents describe themselves as natural boundary crossing people. They are used to work with people from other areas and they have not experienced any difficulties with working across disciplines. The goals of the vision “Ringpärmen” have been followed but in an independent way. In the design of the knowledge creation course, they have looked at how the other Arenas have implemented this but the uniqueness in combining health, lifestyle and technology was so new and made it important to figure out how to design the course and this led to their own design. The “first” Arenas have been a help as discussion partners and inspirations. In relation to knowledge creation it is mostly Arena Learning that has been a support.

The atmosphere among the people active in this Arena is described as engaged and focused. The discussions are described as free and open with spontaneous contributions while the form of working and meeting is described as quite traditional. The work is described as very inspired and engaged but also that from the point in time when the knowledge area became an Arena most efforts have been focused on practical matters.

The contacts and cooperation across boundaries is experienced in a positive way among all of the respondents. The work within the Arena has lead to an expanded “contact area” people has learned to know more people and to know about more people and this has lead to new contacts and in some cases to new projects. One of the respondents says that a more flexible way of thinking is created through the work across boundaries. This is also reflected among the students. They are more flexible and read courses at more than one campus, from many disciplines and this has opened up the boundaries. Reflection is something that has become an important issue in the design of the Arena. Much effort has been done to create possibilities for the students to reflect on their learning.

When it comes to the respondents and their reflections this is described as something that happens during or between meetings. These reflections are described as being unplanned and individual in contrast to the opportunities for reflection that are designed for the students.
3.4.2 Arena Innovative Technology and Enterprise
My interviews show that the group of people working in Arena ITE are very engaged in the development of the Arena and two out of three respondents describe themselves as natural boundary crossers. They have managed to create an atmosphere of trust and engagement. Through the interviews I get a picture of a group where creativity, openness and entrepreneurship thrive. Through the work a method of giving and taking has developed according to one of the respondents. The respondent says that they really communicate and that it is an open communication.

The respondents say that the model with greenhouses has worked as a cape which has made it possible for them to be creative at the same time as it has given them a frame for the work. One of the respondents also describes the atmosphere in the group as it is because they do not view each other as competitors competing over students. This has been important in the work across disciplinary boundaries. The group has created a strong feeling of belonging and community.

3.4.3 Arena Global Resources
Arena Global Resources consist of more than half of the disciplines at the university. This is also mirrored in the courses during the first semester for the undergraduate education. But even though there are so many disciplines active in the Arena, it is described by the respondents that the work across disciplinary boundaries has worked without any difficulties. They share a positivistic view on science is one argument for this. Another argument given by one of the respondents is that they are used to work across boundaries in their discipline so this has not been a new experience for them.

Considering the large amount of participants it was a difficult job to find a structure within the Arena that everybody could live with. The way to do this was through many open discussions and through this they identified the nine exam areas. This was a magnificent match says one of the respondents but when the nine exam areas where
identified they also had found a structure to work within. It has been an open atmosphere on meetings says the respondents and it has been OK to argue and have different opinions. Two of the respondents say that they had expected it to be more difficult to work across disciplinary boundaries than it turned out to be. The problems have been found in other areas instead

3.4.4 Comparative Summary of Culture
Three out of four in Arena LHT, two out of three in Arena ITE and one out of three in Arena GR describes themselves as natural boundary crossers, i.e. that they have been working or studying in different disciplines or that they are used to cooperate with people from other areas and that this way of working therefore is nothing new for them. The general impression from all interviews is that the respondents are very positive towards work across boundaries. It is also described in Arena ITE that they don’t feel like competitors even thought they represent different disciplines, this group has also created a strong feeling of belonging within the group. It is also described that even though Arena GR consist of more than 30 disciplines they generally share the same positivistic view on science and that it therefore has been quite easy to cooperate.

The respondents in all three Arenas describe an open and creative as well as engaged and focused atmosphere within the Arena. In all Arenas there are open and free discussions, some of them are even described as “hot” but they also say that there is no prestige. They all feel that it is an environment where it is OK to have a contradictory idea in the discussions. In Arena LHT and ITE the importance of having face to face meetings is emphasised.

In many ways the culture is similar within the three Arenas; it is described as an open and creative working environment. The structure of the groups differ however in that Arena ITE have a rather simple structure while Arena LHT and Arena GR even moor have quite complex structures.
3.5 Hindrances and Facilitators

*Important input can be found in the interviews on where problems have occurred and what has facilitated the processes and therefore I present these results under its own heading.*

3.5.1 Arena Lifestyle, Health and Technology

Time given to some of the people active with the work within the area is mentioned as an absolute facilitator for meetings. Without this it would not have been possible to create the new Arena. The greatest advantage with the Arena is that the contact areas have expanded, new meetings have taken place. The contact across disciplinary boundaries have increased and given many possibilities. Everybody involved have given impulses to each others and new ideas and new projects have been formulated. The work across disciplinary boundaries is viewed by the respondents as the great return of this work. Possibilities to make contact with people from many disciplines, external people and also with the students are also mentioned.

The possibilities to participate and discuss in other groups has also been a great facilitator according to the respondents. Examples mentioned are the course in knowledge creation that is given to teachers. This has been a meeting place where people from many disciplines have met and learned and discussed knowledge creation. Also the program for leaders\(^\text{12}\) where leaders from many disciplines have met and discussed is mentioned as an important meeting place and facilitator for the work within the Arena.

Practical matters have been much in focus during the first year of the Arena. One of the respondents say that questions like how situations or meetings can be created in the every day life of the university that correspond to the vision of a creative university have been discussed and problematic to find solutions to. Examples of ideas that have come into practice are usually given from the student perspective.

Many of the problems are also discussed with examples from the student’s perspectives. Geography and demography are mentioned as hindrances when planning the education

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\(^{12}\text{Ledarskapsprogrammet}\)
given on the Arena. Much work has been done on questions as how can we give the student access to computer rooms at all campuses, which courses can the student chose to this exam, how can we make it possible for the student to read courses in all campuses. In some ways logistical problems have become what lead the way instead of the vision. One of the respondents raises some questions of what the results will be of the virtual campus. Which social consequences will we meet? And isn’t the time for studies a time for personal meetings? Will the university be a natural meeting place in the future?

The high time pressure and also the distances between campuses is mentioned by the respondents as aspects that has affected the work and the possibilities to create trust, engagement and personal meetings. The chances to be creative and to think in new ways are described to have been hindered by practical matters. While the fact that management have supported and prioritized the work with the Arena has been a facilitator. In this way it has become clear that this is important work. The work is also described as autonomous, which is important for knowledge creation.

3.5.2 Arena Innovative Technology and Enterprise

The document which describes the idea of greenhouses has been a great facilitator for the group as it has given them a shared picture of the core of the Arena. One of the respondents says that this picture is important because it has become a way to see “why are we doing this”. The greenhouse is used as an example in many discussions and it makes it possible for the group to communicate and it is a picture which they themselves have created, and this gives the Arena a strong identity.

The idea is that the greenhouses should run like a “red thread” all the way through the education. But it has been difficult to create a curriculum in balance between different activities and different courses. The respondents describe that it has been difficult to find alternative ways for examination in the greenhouse projects. Also many teachers are used to do this with a written exam and this way of working with alternative examinations is new for them.
The fact that they have had the same room for meetings most of the time is described as something very positive. The program for leaders is mentioned as a meeting place which has given indirect help in the work with the Arena. At these meetings it has been possible to raise ideas and to get engaged help. It has also been possible to identify people with different competences at these meetings.

In the beginning of the work with developing the Arena it would have been good to have a support for the process according to one of the respondents. The respondent describe that it was a period of uncertainty, with no clear goals or routines. But as the process with the creative university as a whole has developed in parallel with the work within the Arena they have all grown and today they have clear goals and they have developed routines for their work. Some of the active people in Arena ITE is or has been active in other Arenas as well.

3.5.3 Arena Global Resources
The meetings and work within the Arena is seen as a large meeting place where new connections are made. The respondents says that you get to meet people and get to know their areas of competence and interests, this leads to new possibilities in creating large research projects. The knowledge creation course for teachers has been a great help in the design of the first semester for the students. Also the meetings for coordinators are mentioned as a very valuable meeting place. Most people active in the Arena are located at the campus in Luleå and this has made it easy to have personal meetings. One negative aspect with all the personal meetings that is mentioned by one respondent is that people from Skellefteå that are engaged in the Arena may have become outsiders.

The coordination of the first semester was a bit tentative the first time it was given in the Arena. Again this may be explained by the large amount of disciplines taking part in this. The work with the first semester has been funded with money from undergraduate council\textsuperscript{13}. This has made it possible to have meetings and to work with evaluations of the first semester and to develop and coordinate the courses. It is usually difficult to find time

\footnotesize{\textsuperscript{13} Grundutbildningsrådet.}
to reflect on learning, but the funding of the group working with the first semester has given them an opportunity to do so according to one of the respondents. One of the respondents has the opinion that there is too little done with the natural meeting places at the university as a whole. For example the classrooms are mentioned as meeting places for knowledge creation but they are not designed for this, they are designed for teaching. Also the restaurants Gelbe Hof and Centrumrestaurangen could need to be redesigned and freshened up to become meeting places for students and employees according to the respondent.

One of the respondents says that they haven’t come so far in the design of meeting places for knowledge creation, and that this is a very difficult question. In some sense they feel alone in this and maybe this could need to be approached as a question for the whole university says the respondent. One problem mentioned by the respondents is the high time pressure in launching the Arena and in relation to this it has been a problem in some cases been to find people who wanted to take responsibility for different areas or in other cases people who only were interested in grabbing large pieces of the activities. Moreover, the development of all Arenas has been parallel processes according to one respondent.

One of the hindrances mentioned by a respondent is the financial framework. It is easy to get carried away in planning the courses to be optimal for the students’ knowledge creation, but the fact that there has to be economical balance makes it important to redesign in accordance to this.

3.5.4 Comparative Summary of Hindrances and Facilitators
One of the respondents in Arena LHT says that they have used some of the other Arenas and their experiences as support while one respondent in Arena GR says that all Arenas has worked and developed in parallel. In Arena ITE several of the active people have been active in other Arenas and they bring their experiences with them into this Arena.
The expanded contact area that is a result of the work within the Arenas is described as a great opportunity by the respondents. It has also resulted in several new multi disciplinary research projects. The respondents in all three Arenas describe that they have developed new flexible ways of thinking and that they feel that it has been a very creative work.

Time is described both as a facilitator and a hindrance in the work. It has been a facilitator for those who have had funding for this work. At the same time the high time pressure is described as a hindrance by others. In relation to time, economy is also mentioned as a hindrance for creativity i.e. it has been easy to be creative and to design high quality courses but in reality it is not possible to give all lectures you want or in the way you would like because of economical frames. Also the long distances are mentioned as a problem for the work in Arena LHT and Arena GR, while this is not mentioned in Arena ITE. Other practical matters that have been hard to handle is e.g. how to find structure and clarity in the courses and to design the programme of study has taken much effort.
4 Concluding Discussion
This report began with a short introduction to the background and setting for this study. This was followed by a short description of my methodological strategy. After this the vertical and horizontal analysis was presented. The purpose has been to gain an understanding for how these new groups working across traditional boundaries handle their interactions and communications in the creation of a shared context for knowledge work.

All three Arenas have been successful and innovative in that they all have been able to create new undergraduate programs and new research projects. This work have been supported by the social networking which can be viewed as a communications process in which knowledge is shared and new knowledge is created. The creation of a shared knowledge base within the Arenas have facilitated and made the innovation process possible. The social networking gives possibilities for redundant knowledge and this redundancy is essential since it gives the ability to envisage a social system of joint actions. The creation of meeting places in support for social networking at LTU is needed and could be furthered. It is important that not only physical meeting places are created, virtual and mental meetings places which supports the integrated knowledge creation must also be created. There has to be a balance in IT focus and social focus. The IT support must be adapted to both the process and the context of the working groups.

The interviews have showed how important it is for the working process to create a shared mental context. This is related to the importance of a shared purpose. The people within Arena ITE have been able to create a strong shared context in which they work together. This can of course depend on many things but aspects that stand out are that the active people in Arena ITE all comes from the campus in Luleå while Arena LHT and Arena GR have people from Boden, Luleå and Skellefteå active in the work. One other clear difference between the Arenas is that Arena ITE is a rather small, tight group of active people while Arena LHT and Arena GR consist of many subgroups which are more loosely coupled. The respondents in Arena ITE and LHT emphasise the face to face meetings and the creation of trust among each others right from the start is emphasised in
Arena ITE. The active work within a virtual context has been a facilitator for Arena ITE. The fact that they have developed the idea of greenhouses has also given them a strong shared mental picture of the Arena which of course is important. Some of the active people in Arena LHT and ITE have been active in other Arenas and have from this gained valuable experiences.

Nonaka’s model (1995; 1998; 2000; 2003) describes the way in which knowledge is converted from tacit to explicit and again to tacit through a spiral process. In the knowledge creation process, new knowledge is created through a knowledge spiral where the activities socialisation, externalisation, combination and internalisation are key. In a process like this the spiral is of course taking many turns on several levels at the same time. The contexts for these activities are four types of Ba which gives a context to each activity. Ba is an interaction space involving language and communication. It is the shared context by those who interact with each other and through these interactions knowledge is created. The four types of Ba can take place in two interactive and two media dimensions. The former is on an individual or a collective level and the latter is the media used in interaction and this can be either face to face or virtual. From my interviews it is clear that face to face interaction has been used most of the time while virtual interaction has been rarer and that it is mostly email that has been used for this.

All three groups have in a natural way followed the spiral of knowledge creation and used different Ba’s for communication and interaction. They have also created several new Ba’s in the form of physical meeting places and in subgroups. This supports a realistic view on knowledge management and show that a totally IT driven approach don’t give opportunities for the important relationships and shared understandings. Information and communication technology (ICT) is used to complement these processes and in this way increase the ability to communicate across boundaries in time and space. Used the wrong way ICT can undermine knowledge sharing and creation by reducing opportunities for informal contact and strengthening the existing organisational walls based on functional and geographical differentiation. Therefore careful attention is needed to the potential impact of ICT on the knowledge work in relation to the creation
of new groups. It has been a natural process to begin work with face to face meetings as a way to create the shared context for the work and that as the process proceeds the respondents now considers virtual media.

It is clear that the many face to face meetings have been a crucial media for knowledge sharing. The challenge now lay in the work with the creation of virtual environments that are encouraging knowledge sharing and creation. We must understand knowledge as an embedded in and constructed from social relationship and interaction. Knowledge cannot simply be processed it must continuously be recreated through dynamic interactive and social activities. The people active in these three Arenas were not only moving knowledge from one person to the other they were also creating new knowledge and shared understandings thorough the synthesis and interaction of group members. During the working process they have created many opportunities for interaction and knowledge sharing and creation.

The many face to face meetings are time consuming but it has also allowed for them to develop a common language and to appreciate each others world views. This has made it easier to develop a common sense of purpose, which is very important for successful integration across boundaries. Exploitation of existing knowledge is a small part of knowledge management in innovation projects and processes of exploration are crucial because this is by which new knowledge is created. It is important to invest in interpersonal relationship building in heterogeneous groups in order to create knowledge. The face to face and verbal interaction was used for knowledge sharing in all three Arenas even despite the large amount of travelling in some cases. Those involved have recognised that embedded tacit knowledge is difficult to share through other media and according to Nonaka et al (1998; 2000; 2000; 2003) face to face interaction is the base for knowledge creation.

When we decide to work in this way it is important to offer support for the groups to communicate and interact even though the distances are large. This has been handled by the groups themselves in this work. For virtual work it will be very important to create a
context which makes it possible to share experiences and to socialize. The design of these systems must support the knowledge creation spiral and thereby offer different types of Ba. This is also important for the continuing work within the Arenas. It is also important that we reach a critical mass of users for the new types of communication media if we want people to invest time to learn and use them, otherwise the systems will stay unused.

We need to choose systems that support media richness for the knowledge creation process. Face to face communication is the type of communication which is the most media rich while email is viewed as rather lean in information richness theory according to Lee and Ngwenyama (1997). Within the work in all three Arenas the telephone has been used for clarifications and when face to face meetings is not possible this is the next best (richest) medium for the processes of externalization of tacit knowledge. However, Lee and Ngwenyama have showed that media richness needs to be considered as a subjective and contextually dependent phenomena rather than an objective characteristic of the technology. Arena ITE is the only Arena which has used a virtual context (email) as a medium for knowledge creation so far. Their use of email show that in this context email has worked as a rich medium.

The results from the interviews have in this report been presented in the context of Arenas as a way to keep the respondents anonymous but still in a rich way with the ambition to give a rich picture of the work within the Arenas. Showing how communication, interaction, knowledge creation and the creation of shared context have been done. These results will be further analysed in two papers which are planned and they will give a deeper understanding of the creation of shared context in boundary crossing work.

Finally I want to thank all respondents for their willingness to share their experiences and for their openness in doing this.
List of References


Appendix 1. Interview Guide

Questions

Introduce with a presentation of my self and the purpose for my interview. Explain why I want to record the interview and ask for approval of this. Also explain how I will handle the data and how the material will be compiled and presented.

Background questions

Ask the respondent for a presentation of him/her self. Where do you work, what kind of work do you usually do, which Arena are you active in and how and why you became active.

Describe the Arena, how is the Arena structured e.g. undergraduate education, courses, sub groups working in the Arena, research etc.
Who is active within the Arena, different disciplines, campuses, persons etc?
The core idea of the Arena, what have been the core ideas for building/designing the Arena
Did you use the strategy “Ringpärmen” as a framework for this, can you describe the development process, what have been mostly focused on.

Meeting Places

Can you describe how you have contact with others from the Arena? How do you communicate and interact?
What meeting places and forms for meetings are usually used in the Arena and which types have you participated in?
How do you meet, where do you meet, when do you meet.
What happens at these meetings, can you give examples and describe events at meetings?
Have you used any type of virtual meetings? Can you give some examples? (Intranets, net meetings, email etc)
Have you experienced mental meetings such as creating a shared mental model of the Arena? How did you work with this?

Integrated Knowledge Creation

In which ways have you handled the question of knowledge creation?
Have you discussed the base for knowledge creation?
Where, when and how does knowledge creation occur in the Arena?
Who is creating knowledge (students, teachers others?)
How is knowledge, used, spread and shared within the Arena?
Have there been any discussions on different views on knowledge within the Arena, what is considered knowledge within the Arena?
In what ways have you found the needed competences for the work within the Arena. Did you have a strategy for this?
Creation of trust, engagement - Individual meetings – face to face - Knowledge and cultural visions?
Group meetings face to face – mental models and skill turning into shared concepts.
Reflection and analysis through dialogue. Individual reflection and analysis.
Virtual collective meetings, creation of new knowledge – combination.
Individual virtual meetings. Internalization.

**Culture**
Describe what roles there are in the Arena and how they are spread.
Describe how the Arena is organized.
Is there a shared mental model of the Arena? What is the core of the Arena?
Is the work autonomous?
Is there trust and engagement among the people in the Arena? How was this accomplished? Was there a strategy for this?
What kind of support have you received?
What facilitators or hindrances have you met in the working process?

Which important question have I missed to ask? One question that you have waited to give an answer to during our conversation.

Thank you for your time.
Appendix 2. Note to Respondents

Hello
As I promised when we met I am now sending you the report which is built on the interview I made with you and nine other people active in three Arenas. I hope that you will read it through to see if my descriptions of your work correspond to the one you have. I hope that you will let me know if there are any faults or misunderstandings in the report as soon as possible. I would also appreciate if you could confirm the picture I draw in the report if you think it is accurate. I am planning to send the report to the international evaluation group on November 10 and it is therefore important that your comments are sent to me as soon as possible.

Finally I want to thank you again for the time you were willing to give me during the interview. I hope that you will find the report interesting.

Many Regards

Marita Holst