Radboud University Nijmegen

Knowledge sharing and retention through the use of collaboration software – A bachelor thesis

How does the IBM Lotus software facilitate the knowledge sharing and retention in GiPHouse

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1. Problem statement

In this chapter I will highlight the main problems I will discuss in this thesis, specify the exact research questions I want to answer and provide some background to the problem itself. I will also provide a brief introduction on how I have performed the actual research.

1.1. Problem background

Knowledge sharing and retention in a company is an important issue. When people in a company or organization leave, we do not want them to take all their knowledge and experience with them. If they do, errors made in the past will be repeated and solved problems will have to be solved all over again. This can be summarized as not wanting to re-invent the wheel, which is of course a very understandable point for organizations to take. After all, solving the same problem more than once will cost the company time, manpower, and ultimately: money. It has to be noticed that this works both ways. If knowledge remains in an organization this will not only prevent expensive mistakes from being made again, but will also provide building blocks with which new people can form new solutions and ideas that will help an organization to reach its goals, whether they be of monetary, scientific or of another nature altogether.

When looking at this problem, we see two distinct approaches. The first takes the perspective of management science. When looking at it from this perspective, we see the sub domain called knowledge management which looks at the problem from the position of the manager and tries to solve it through the use of managerial interventions. These interventions can take the form of just about anything in the manager's book, from acquiring new facilities and equipment to reassigning staff or training them to perform their duties in another way (Hislop, Knowledge management in organizations, 2005). This thesis however, will not take a look at this approach but will look at this problem from another perspective.

The other perspective is that of an IT professional who will try to solve the problem using software tools. A main category of these tools is called collaboration software, which has (amongst others) the main goal of facilitating knowledge sharing (between employees) and knowledge retention (throughout the company). These tools can use a wide variety of systems to actually facilitate the knowledge sharing and retention. It can range from having a blog where people write down problems they have solved up to specially designed applications with which project templates, problem/solution documents etc may be shared through a highly indexed system. But even a simple project administration may be seen as some form of collaboration and if stored, retains some of the knowledge gained in that specific project. The problem with this, however, is that the knowledge is still hidden inside the administration and not explicitly codified. And it is this codified knowledge that is the most valuable to us, since it is easy to transfer between people and organizations as a whole. (Hislop, Knowledge management in organizations, 2005) This is the perspective I will use for this thesis.

A big competitor in the collaboration market is IBM Lotus, a range of products which (when used together) provides a collaboration environment. This environment is present at the Radboud University's GiPHouse Software producer. GiPHouse is a student-run software development company, which has the unique property that the entire staff changes between semesters, as new students take the place of the older students who have left the project. This means that knowledge management is absolutely vital for this company, but past experience has shown that before the

introduction of a collaborative environment literally all knowledge left the company, and everything had to be re-invented. Even the roles within the company are redefined with every new iteration. This situation has led to the fact that every semester there was a startup period of at least three weeks in which the company had to invent itself again, before any real work was done. This time period may seem very small considering a real company may take years to define itself, but in a 20 week semester this is still a considerable amount of time. This time may be saved by codifying and storing the knowledge gained in every semester, and then efficiently passing it on to the new group of students. This is what GiPHouse hopes to achieve by implementing and using the IBM Lotus collaboration software.

1.2. Research questions

In this thesis I will provide a definition of 'knowledge sharing' and 'knowledge retention'; first as general terms, and then refine them in the context of GiPHouse. Using this information, I will define an appropriate way to evaluate the efficiency (in terms of how well it facilitates knowledge sharing and retention) of the system in place at GiPHouse. Finally, I will perform a case study using the defined methods on the system at GiPHouse and give an evaluation of the system in the context of GiPHouse. Keep in mind that this will not be an evaluation of the system itself (which has been done extensively before) but rather on how this specific system is appropriate in the GiPHouse environment.

To summarize the research question into one main question:

- How well does the collaboration software in use at GiPHouse facilitate:
    - Knowledge sharing
    - Knowledge retention

This leads to the following sub-questions that have to be answered:

- How can knowledge be defined
- What is the definition of knowledge retention in a general context
- What is the definition of knowledge retention in the GiPHouse context
- What is the definition of knowledge sharing in a general context
- What is the definition of knowledge sharing in the GiPHouse context
- How can knowledge sharing be measured in the GiPHouse context
- How can knowledge retention be measured in the GiPHouse context
- How well is knowledge retention achieved by the system in use by GiPHouse
- How well is knowledge sharing achieved by the system in use by GiPHouse

If all these questions are answered, then the main question will also be answered.

1.3. Research method

This thesis will attempt to answer the questions asked in the previous section in two ways. The definition and measuring questions will be answered through literature research. I will use definitions which are generally agreed upon and expand on those to fit them into the GiPHouse context. When I have laid down a framework on how to define and measure knowledge sharing and retention, I will use this information to create a method to evaluate the GiPHouse situation by means of a case study. In this case study I will measure and rate the levels of knowledge sharing and

retention in the organization at this moment, and compare them to the levels they were at before the collaboration system was put into place. The final evaluation of the system will be drawing on my own conclusions formed after evaluating the case study results. Finally, I will also give recommendations on the system based on my evaluation.

2. Knowledge sharing and retention

In the first part of this chapter, I will first discuss some of the key elements of knowledge; what it is and how it is defined . Second, I will discuss what sort of knowledge definition I will be using for the remainder of this thesis. Then, the difference between sharing tacit and explicit knowledge will be clarified. Finally, a short introduction to the 'softer' problems associated with knowledge sharing will be given.

In the second part of this chapter I will put the emphasis on knowledge retention and the approaches one can take to facilitate knowledge retention in organizations.

2.1. What is knowledge?

In order to evaluate knowledge sharing within an organization, it is first important to understand exactly what knowledge sharing is, and to do this we first need to get an idea of what knowledge itself is. When looking at knowledge, there are two main schools of thought on how knowledge should be defined, namely 'tacit knowledge' and 'explicit knowledge' (Hislop, Knowledge management in organizations, 2005). Tacit knowledge states that knowledge is something that people possess. This can be expressed as skills such as basic tool skills, or even complex cognitive skills such as developing a website. The main problem with tacit knowledge in terms of knowledge sharing, is that it is nigh impossible to codify this knowledge. By codifying we mean transferring it to a medium that can be used to deliver the knowledge to another person, like paper or a collaboration tool. Some people even claim that tacit knowledge may even be subconscious, and therefore completely impossible to codify. A widely used example is experience. One can be told to hammer a nail into a piece of wood, but even when told, it will take practice to actually hit the nail (and not your thumb). This sort of experience is impossible to codify.

Explicit knowledge on the other hand is exactly what the name suggests it will be. It is "codifiable, objective, impersonal, context independent and easy to share" (Hislop, Knowledge management in organizations, 2005). Examples of explicit knowledge are how to build a computer or how to bake an egg. This form of knowledge is therefore assumed to be easy to share as it can be written down, or demonstrated; no practice or 'experience' is needed.

Now, although I stated there are two schools of knowledge definition I have to clarify that these schools are not really opposites in some sort of spectrum, but rather two types of knowledge. (Nonaka, Toyama, & Konno, 2000) This has also been stated by Nonaka, who is widely considered to be the founder of modern knowledge management. What this means in practice is that there are two distinct sorts of knowledge, which have to be treated separately from one another. Rules, facts or statements which apply to tacit knowledge might not be true for explicit knowledge, and vice versa.

All this leads to the fact that there are now two perspectives on knowledge, the objectivist perspective and the practice-based perspective on knowledge. The objectivist perspective focuses on codifying and collecting knowledge and create mechanisms (such as IT) to facilitate knowledge transfer. It also states that knowledge is actually part of a spectrum, and that tacit and explicit knowledge are direct opposites. The second perspective, the practice-based perspective, states that knowledge can only be transferred through social interaction and that communication should be improved (for example through the use of IT) to facilitate knowledge transfer (Hislop, Knowledge management in organizations, 2005). This perspective also states that all knowledge is not part of a

black and white spectrum (tacit vs. explicit) but that all knowledge contains elements of both. Most IT oriented people will choose the objectivist perspective because it suits their needs and philosophies best, but I personally think the practice-based perspective is much closer to reality. Therefore, I will from here on use the practice-based perspective to discuss all knowledge related topics relevant to this thesis. To make things a little bit clearer, I have gathered the main differences between the objectivist and practice-based perspectives into the following table, based on (Hislop, Knowledge management in organizations, 2005).

Objectivist perspective	Practice-based perspective
• Knowledge is derived from an intellectual process	• Knowledge is embedded in practice • Knowing and doing are inseparable
• Knowledge is a disembodied entity/object	• Knowledge is embodied in people • Knowledge is socially constructed (i.e. through social interaction)
• Knowledge is objective 'facts'	• Knowledge is culturally embedded • Knowledge is contestable • Knowledge is socially constructed
• Explicit knowledge (objective) is privileged over tacit knowledge (subjective) because it is easier to codify	• Tacit and explicit knowledge are inseparable and mutually constituted
• There are distinct knowledge categories (i.e. tacit vs. explicit)	• Knowledge is multidimensional

Table 1 - Objective vs. Practice-based knowledge perspectives

As a final statement in this section, I would like to point out that knowledge is a philosophical term is of course much broader then the definition I have given here. However, this is the definition which is relevant for the case study, and as such will be the definition I am going to use from this point onwards.

2.2. Knowledge sharing from an explicit knowledge perspective

Since knowledge is defined in two separate ways (tacit and explicit) it is also logical to assume that knowledge sharing should be defined in two distinct ways as well. Even though in the practice-based perspective these terms are intertwined, we must still look at the differences between sharing these two types of knowledge. In this section I will discuss how the established world of knowledge management looks at knowledge sharing from an explicit knowledge perspective, how it can be facilitated in an organizatorial context and what problems and difficulties might arise while sharing explicit knowledge. All these aspects will be applied to the case study in a later part of this thesis.

Explicit knowledge, as stated earlier, is defined as being codifiable. This fact is the exact reason why most people prefer to look at explicit knowledge while discussing knowledge sharing. Because explicit knowledge can be codified, it is also possible to easily transfer this knowledge to other people, or more general to other 'actors'. Actors, in this context, are all 'things' which can receive and store knowledge. Notice that when discussing knowledge sharing I do not mean that the receiving party should 'comprehend' or 'understand' the knowledge he/she/it is receiving. The actor should only be able to 'store' the knowledge for future reference.

In (Grant, 1996) the mechanism for sharing explicit knowledge is explained as "explicit knowledge is revealed by its communication. This ease of communication is its fundamental property". This

confirms what I explained earlier; that communicating explicit knowledge is easy. To understand how the sharing itself actually works, (Bolisani & Scarso, 2000) defined what is now being called the 'conduit model'. Figure 1 shows the conduit model as a diagram.

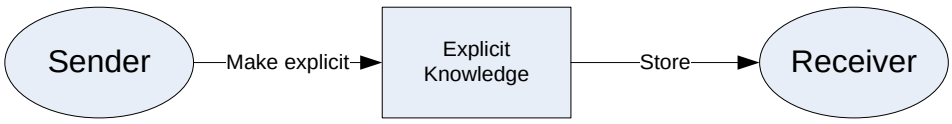

Figure 1 - The conduit model of knowledge sharing

You may note that there seems to be a superfluous part to this model: the two arrows carry the description 'make explicit' and 'store'. Since we are trying to send explicit knowledge which by definition is already explicit why do we still need to have these steps? The answer is to be found in the (unfortunate) inconsistency of knowledge-related literature. Explicit knowledge may be the knowledge which can be codified (the definition I gave earlier) but it may also refer to knowledge which already is codified. In this case, the conduit model states that knowledge in one sender's 'head' must first be codified. This can mean any number of things such as verbalizing it, putting it on paper, storing it in some database, making a movie, etc. When the knowledge is made explicit by the sender, the receiver or receivers may use this explicit/codified knowledge to store it for themselves, either to memory or in another codified form.

Another assumption made by this model, is that the codified knowledge must be understandable for the receiver without any interaction with the sender. A good example of such a process is the reading of an instruction manual. The user of the appliance must be able to understand how to operate the device without any form of interaction with the person or persons who developed the device. A further requirement for this process to be called a success is that the receiver must also derive the exact same meaning from the knowledge that was given to it by the sender. In other words, a line like 'press the blue button twice' must be very clear and non-ambiguous to the receiver. If it is not clear (i.e. there are two blue buttons) then we do not consider this to be a valid knowledge sharing process. (Hislop, Mission Impossible? Communicating and Sharing Knowledge via Information Technology, 2002)

To conclude this section, we can see that if knowledge is classified as 'explicit' we can easily transfer the knowledge by use of an electronic system, or more specifically: use a knowledge sharing tool (such as the IBM Lotus suite) to share knowledge between users. However, as discussed earlier: explicit knowledge may not be so common as we hope. In fact, it can be argued that it does not exist at all, and all knowledge is in fact tacit. In the following section I will discuss the problems that arise when sharing tacit knowledge.

2.3. Knowledge sharing from a tacit knowledge perspective

We have now concluded that sharing explicit knowledge is easy, and can be facilitated by the use of IT. However, even in the early days of knowledge management, (Polanyi, 1969) stated that "the ideal of a strictly explicit knowledge is indeed self-contradictory; deprived of their tacit coefficients, all spoken words, all formulae, all maps and graphs, are strictly meaningless". Ouch. Basically, if we follow this reasoning pattern (and indeed, literature shows that this is the way to go) we can throw all knowledge sharing through ICT out of the window, since knowledge cannot be made explicit.

So, given that making knowledge explicit does not work, then how are we going to share knowledge from a tacit knowledge based perspective? Before going into this question, I will first improve the current definition of tacit knowledge used in this thesis. In chapter 2.1. What is knowledge? I defined tacit knowledge as "knowledge … that people possess". And by possess I mean knowledge that is embedded in people, as stated in Table 1. This means that tacit knowledge in this context can be gained primarily by experience. Or, to put it into an educational term: "Knowing by doing". When performing a certain act, you gain more knowledge about it. Of course, one can now immediately identify a big problem here: how does one share gained experience?

As opposed to explicit knowledge, there is no single solution (i.e. the conduit model) to solve the problem of sharing tacit knowledge. There are several organizational and personal methods that can be undertaken to try and share tacit knowledge. Observe that I said 'try' to share, since no method can truly convey the personal nature of tacit knowledge that any given actor gives to it. A good example of an (ancient) method of transferring knowledge given by (Hislop, Knowledge management in organizations, 2005) is the 'master-apprentice' system. A system which has been in use since about 3000bc by such innovative people as the ancient Egyptians and the ancient Greeks. In this system we have an experienced master who can perform a certain art of craft. This knowledge is to be transferred to the young and inexperienced apprentice. In this situation, the master does not use a manual (i.e. explicit knowledge) to teach the apprentice, but in fact he starts a process of communicating, interacting and demonstrating with the apprentice. Over time, the apprentice will combine all the spoken information he has gathered, the examples he has witnessed and the practice he has done and combine them into his own version of the tacit knowledge needed to perform the job his master has been trying to teach him.

In modern days, a 'master-apprentice' system would be utterly impossible to implement in an organization of any real size. So instead organizations have begun using 'communities of practice', which at the moment is considered to be *the* method in knowledge management to share knowledge between people. This is not a new concept, but with the advent of modern knowledge management it has become more popular among managers to share knowledge since it suits the practice-based perspective very well.

A community of practice may be defined as "A group of people who have a particular activity in common, and as a consequence have some common knowledge, a sense of community identity, and some element of overlapping values" (Hislop, Knowledge management in organizations, 2005). If we compare this to the 'master-apprentice' system we see a lot of similarities. A community of practice means that a group of people are working together to achieve some set of goals. An example may be a software development team who are working together to develop and implement software. Let us assume that the team changes on a regular basis, but only on a per person basis. Now, the team is working together and a new team member is brought in. This new team member can then interact, communicate and observe the other (experienced) team members much in the same way as the 'master-apprentice' system discussed earlier thereby gaining the tact knowledge of the entire team. The team may also have some sort of electronic database to facilitate the sharing of domain-specific items such as what tools to use in what situations or a list of domain experts to contact when necessary . These two methods combine the tacit and explicit aspects of the group's knowledge and allow them to be transferred to new members of the group. I will discuss this aspect of tacit knowledge sharing in more detail when discussing the GiPHouse case.

2.4. Sharing knowledge in a general working environment

After discussing the sharing of both explicit and tacit knowledge, I now come to the point where I will discuss how to share knowledge in general, when looking at a working environment. As I have already stated before, there are two big groups in the information management world. The first group claims that tacit knowledge may only be shared through direct social interaction, i.e. a face-to-face conversation and that IT systems, however advanced they might be, will not be able to assist in sharing tacit knowledge. Since the practice based perspective makes it very clear that all knowledge consists of explicit and tacit elements which cannot exist independently, this automatically leads to the conclusion that knowledge sharing through ICT is impossible. If I were to adhere this point of view, then I would not need to perform a case-study as its conclusion would be quite clear: the information system does not improve the knowledge sharing in GiPHouse.

Fortunately there is also a second group who claims that IT may not be the deciding factor in sharing tacit knowledge, but the ever increasing availability of communication technology makes it possible to use IT to facilitate the social interaction needed to share knowledge. Examples of this include video conferencing, chatting, voice communication such as the telephone, etc. The keyword here is 'information richness'. Information richness means the extent to which the social interaction influences the information being shared. The amount of response possible and the speed at which feedback may be given are of relevance to the information richness. Figure 2 gives some examples on information richness for several communication technologies in relation to face-to-face communication.

At the top of this figure we find face-to-face communication. It has been established that face-to-face communication provides the fullest social experience. As we travel from the bottom to the top of the illustration, we see that as information technology becomes more a medium to facilitate a face-to-face conversation (such as video conferencing) the information richness increases as well. From this we can conclude that information technology is able to facilitate knowledge sharing by giving users the ability to socially interact with one another.

Another example of ICT facilitating knowledge sharing is the availability of a central knowledge repository. By putting (explicit) knowledge into such a repository new employees may quickly find their required information in one central point, thus making the sharing of company relevant data much easier. However, this may be straying too far into the field of knowledge retention, which I will discuss in a later chapter and therefore I will leave it at this.

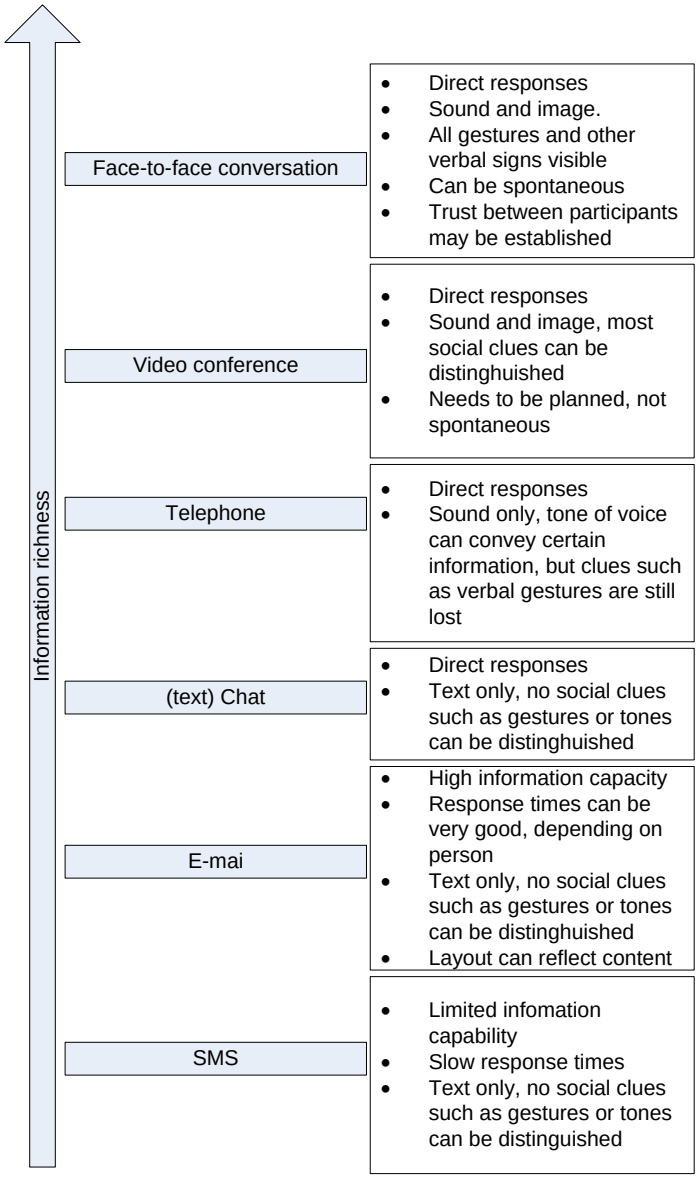

Figure 2 - Information richness (based on (Hislop, Knowledge management in organizations, 2005) and own work)

A final aspect I will briefly discuss in this section is the aspect of 'the employee'. Up until now I completely avoided the human aspect of knowledge sharing. To be more precise, I was assuming that all people in a certain organization are willing to share their knowledge with all those who are interested and that they will politely do it in the exact way the management asks of them. This was in part to more clearly illustrate the knowledge aspect themselves, but was also due to the fact that the human aspect is not an aspect that is addressed in the information technology field, but instead lies more with the management sciences. However, for completeness I feel that I must briefly discuss the human factor.

The first problem is summed up nicely by a very famous expression: "Knowledge is power" (Bacon, 1597). And if we assume that Sir Bacon was correct on this (mind you, he said it in 1597) we can immediately understand the problem. Why would someone share his or her knowledge with the entire organization if it means that it will reduce his or her worth to the organization? This aspect was already identified in the early 90ties by (Hales, 1993). To give a very simple example: Assume that I am the only one who knows how a certain aspect of an ERP works. Now let us also assume that

I am a rather troublesome employee. If I were to share my insight on the company's ERP with the rest of the organization I would be getting myself fired on the spot, since I would no longer be necessary in the organization and my troublesome nature was only tolerated because I was. Although this may be a rather exaggerated example the problem is clear: people need to be motivated to share their knowledge. There is a wide field in the knowledge management literature which deals with this issue. More information may be found in (Hales, 1993).

A second problem is trust. Quite simply, people may be afraid to share some knowledge because they feel other people would be offended by it which in turn may potentially harm their own career. A certain mid-level manager may have information on a large amount of money being lost on the CEO's pet-project. He may not want to share this knowledge with the organization because he is afraid the CEO will fire him for revealing the embarrassing information. This problem may be solved by any number of organizatorial interventions, but I will not discuss these issues here.

2.5. The problem of knowledge retention

As we already observed, the problem of knowledge retention is closely linked to knowledge sharing. After all, we can only keep knowledge when it is transferred from one actor to the other. We have also seen that knowledge has a tacit and an explicit element which cannot be easily seen apart from each other. Therefore, If you have a major reorganization of your organization knowledge may disappear when old employees are fired and new employees enter the organization at a very high rate. The community-of-practice system I discussed earlier will not be able to cope with such changes and knowledge will be lost when the employees who possess this knowledge are lost.

The most obvious answer to this problem is to construct a system that can store knowledge independently of the actors who possess it. However, due to the combined tacit and explicit nature of knowledge this is easier said than done. Although digital systems have evolved over the years to be as interactive as possible they are still reliant on having codified data fed into them. So far, it is still not possible to electronically store true tacit data. This will have to wait until a full artificial intelligence is developed given the definitions I adhere in this thesis. What we do have, however, is an ever advancing ability to store and find codified explicit data.

Over the years, organizations have spend trillions of Euros on developing more advanced ways to store their data, and it shows: Nearly every organization out there has one or more data-storage facilities at its disposal to store every bit of information it can gather. In information science literature this is referred to as the 'memory' of the organization (Chou, 2005). This memory is the only thing that is perpetual in an organization (with respect to knowledge that is): no matter who comes or goes, the organizational memory will always be kept intact under normal circumstances, and given that the system itself can survive the changes. Another added benefit is that knowledge stored electronically may be efficiently searched using information technology methods such as querying. This as opposed to knowledge stored in actors: it is more difficult to assess which employee possesses what knowledge. The main differences between these two types of knowledge retention are highlighted in Figure 3. In Table 2 and Table 3 I have put all the pros and cons discussed in this chapter together for easy reference.

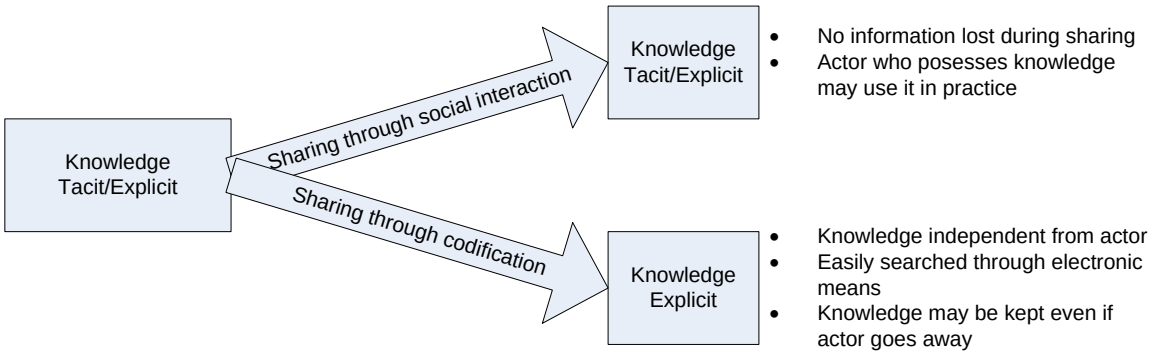

Figure 3 - Knowledge sharing/retention framework

Sharing through codification	
Pros	**Cons**
Knowledge independent from actor	Codification is difficult/impossible
Easily searched through electronic means	Expensive to implement
Knowledge may be kept even if actor goes away	Aspects of knowledge are lost during codification
Explicit knowledge is unambiguous	New, technical risks and problems are introduced to the equation

Table 2 - Codified sharing pros and cons

Sharing through social interaction	
Pros	**Cons**
No information lost during sharing	It may be hard to facilitate social interaction
Actor who possesses knowledge may use it in practice	Knowledge remains locked in people and people may leave
	It is hard to find out who possesses what knowledge

Table 3 - Social interaction sharing pros and cons

3. Knowledge sharing and retention through ICT

As I have already made clear in the previous chapter, it can be very beneficial to use ICTs to facilitate knowledge sharing and retention. In this chapter I will provide a brief overview of the current solutions available to assist in this, and how these technologies are developing over the coming years.

3.1. General introduction of the technology

In terms of this thesis we can identify three different sorts of knowledge sharing/retaining ICTs; these are:

- Knowledge sharing systems: A system used to facilitate knowledge sharing between users. This is mostly done by providing some sort of communication between the various users and/or allowing them to work together on files or projects.
- Knowledge retaining systems: A system used to (semi)permanently storing information generated by an organization. This is mostly done by providing intelligent storage/retrieval facilities.
- Hybrid systems: Systems that offer a combination of sharing and retaining solutions. A downside of hybrid systems is that the current generation only provides parts of the dedicated system's ability to perform its task and may therefore be too general.

There are a lot of concrete examples of these systems, but this thesis is too limited to discuss even some of them. Instead I will give some general examples in the following paragraph and provide a concrete example coupled with the case study in chapter 4 of this thesis.

3.2. Examples of ICTs used to facilitate knowledge sharing and retention

The first method to be widely used is the use of databases to store corporate information. Databases can be in any form or format ranging from punch cards to magnetic tapes and all the way to solid state hard drives. The main characteristic of databases is that they can be used to store any form of data. In the beginning, only raw text could be stored but over the years technological advances have allowed databases to store more diverse media such as hypertext, audio and video. In the future databases may be able to store more advanced forms of media as well, such as three dimensional video recordings which will make the stored date ever more implicit and rich in information (as described in figure 2).

Another characteristic of databases is that they are indexed, and therefore efficiently searchable. This means that if an employee knows what he or she is searching for (in terms of the information need), he or she can search the database using a wide variety of search mechanisms and information retrieval techniques. Because of this, databases are a very popular method to store and distribute corporate information. A downside to databases of course is that they can only store and retrieve very explicit knowledge. Although the technological advances allowing for video storage have lessened this problem a little bit, it is still nearly impossible to store the tacit aspects of knowledge in a static database. This makes databases a *knowledge retaining* ICT.

A more advanced form of ICT available to facilitate knowledge sharing and information is a collaborative environment. In such an environment the employees of a company may work together on various subjects (thereby creating and sharing tacit knowledge), while also having the possibility

to store pure data (explicit knowledge). As we have already seen in chapter 2 of this thesis, the sort of communication possible within the collaborative environment governs the level of tacit information that may be transferred. For a short overview of these communications I refer to Figure 2 in chapter 2.

Collaborative environments may serve many goals. Sometimes it is a tool for a project group to work in a virtual environment. This means for example that programming tools may be shared, files may be shared or that it allows the users to work in certain files together. However, it could also allow for people with wide geographical distances between them to work together on a certain projects without the need for actual face-to-face interaction. This makes collaborative environments a *knowledge sharing and retaining* ICT, although various implementations may be more sharing or retaining based. An example of a collaborative environment will be discussed as a case study for this thesis. For more information on this I refer you to chapter 4.

A relatively new method to share knowledge is in the form of 'digital workspaces', which are based on the popular Media Wiki system; famous for powering Wikipedia. Although they are essentially just another sort of collaboration software, these workspaces are (whether by design or by accident is unknown) actually blurring the line between the tacit and explicit parts of knowledge. In such a workspace, users may write documents or other such media, but may also edit articles written by other people. Because of this, the articles are not just a sum of one person's experience, but may actually be written and edited by a lot of people with no relation to the original author. Because the knowledge has now been made explicit by so many people we can almost call it the sum of many people's knowledge and therefore consider it to be tacit knowledge made explicit. One still has to remember, however, that even though the knowledge itself is now dynamic (and therefore in some ways, tacit) the media in which it is presented is still very static and therefore the knowledge presented is still very much explicit.

The future of digital workspaces is still very uncertain and remains subject to how the technology is going to advance in the future. Perhaps if the media evolves from static information (text, images) to more dynamic information (such as video) we could see an even further rise. However, personally I think that digital workspaces are nothing more than a hype, and collaborative workspaces will soon overtake digital workspaces in terms of functionality and then replace them altogether. Digital workspaces are considered to be *knowledge sharing* ICTs because all knowledge is constantly changing. Bear in mind that there may be an underlying system to actually store all the information (such as the page history in Wikipedia) but this is a database underneath the actual digital workspace and as such is not part of it but merely supporting it.

4. Case study background

In this chapter I will discuss the company I am investigating and the systems they use to facilitate knowledge sharing and retention. Please note that due to the fact I am currently employed at GiPHouse, most information in this chapter will be based on my own experience and may therefore not be completely objective. However, I feel that if I had to completely perform a semi-case study on the company itself before moving onto the actual knowledge management systems I would be straying too far from my actual goal.

4.1. The company – GiPHouse

GiPHouse is a company formed by the Radboud University Nijmegen and is completely run by students of computer- and information science. The main purpose for this company is to allow students to experience working in a software development company, as well as learn how to manage such a company. Third year computer- and information science students act as software developers in a basic software development project. Third year information science students will also work in a more advanced software development project. Finally, fourth year Master students will act as the management of the company and perform all the tasks of:

- Financial management – Responsible for bookings, accounts, etc.
- PR management – Responsible for acquiring new customers.
- Quality management – Responsible for overseeing the quality and uniformity of work done I GiPHouse; also: unofficially responsible for knowledge management.
- Project management – Responsible for overseeing the various software engineering projects being performed for customers.
- HRM management – Responsible for overseeing the personnel of GiPHouse, as well as solving any interpersonal problems between employees.
- Technical management – Responsible for overseeing all supporting technical systems such as the e-mail, the collaboration software and the hour registration system.
- GiPHouse directors – Responsible for overseeing all other management functions, as well as providing general policies for the GiPHouse company.

At first glance, the GiPHouse company thus seems to be an average company. However, there is one particular aspect of GiPHouse that makes it a very interesting company to do a case study: All employees leave after the semester ends, and a completely new management is formed after just half a year. This is because of the fact that GiPHouse is part of university courses which run for just that time, and it is this aspects that makes the problem of sharing and especially retaining knowledge very important.

In order to deal with this problem, one of the previous incarnations of the GiPHouse management decided to search for a method to store the information and experience gained during one semester and transfer this information to the new management without providing too much extra work. A project they did for IBM provided them with a possible solution: The IBM Lotus suite. From this suite, GiPHouse has decided to use two systems:

- IBM Lotus Quickr (http://www-01.ibm.com/software/lotus/products/quickr/) – A project/team based collaboration suite

- IBM Lotus Connections (http://www-01.ibm.com/software/lotus/products/connections/) – A system designed to facilitate contact between various employees of GiPHouse as well as provide a service with which employees can find colleagues possessing certain skills.

There are more products in the IBM Lotus family, but these two systems are the ones currently in use by GiPHouse. In the following sections I will introduce these two systems in more detail, and explain what form of knowledge sharing and retention they are supposed to provide. Please note that I will not explain the system itself in any great detail. If you wish to know more about these systems please follow the links provided earlier in this section. Also, the following sections describe the *intended* functionality of the system. This may or may not reflect the actual usefulness in the GiPHouse company.

4.2. Lotus IBM Quickr

The Lotus IBM Quickr systems falls under the category *hybrid system* (as I defined earlier in section 3.1.). It tries to facilitate both knowledge sharing and knowledge retention. For the knowledge retention part the system offers to option to store workflow documents in a project environment template. So if a new manager first starts off, all he needs to do is to open the relevant management project, and there he will see all documents created by his predecessor, as well as all tasks which are relevant to first beginning the management job. Tasks created in Quickr are step-by-step workflows which describe in detail how, when and why to perform certain acts. This system is not only relevant for managers, but for software developers as well, as they can find workflows on how to deliver certain documents. Since these task are dynamic (they can change and be adapted over time) the system itself allows the company to adapt to changes. Because of this knowledge can be retained even over the boundaries of the new management, and the company prevents itself from reinventing the wheel every single semester.

Another feature of Quickr is that it allows users to share and modify each other's documents. This allows project members to quickly share progress and keep themselves up to date on what other project members are doing. It also allows the management to distribute information to project members and keep them up to date on specific subjects within the company. This feature allows for knowledge sharing through the system.

All of the abovementioned aspects of knowledge sharing and retention are unfortunately only valid for explicit, codified knowledge. Currently, the Quickr systems offers little to no functionality to share implicit (tacit) knowledge.

4.3. Lotus IBM Connections

The Connections system is not at all related to the Quickr system. In fact, besides the name there is not even an internal connection between the two systems. Even logins are different. Connections' aim is different too: instead of providing a collaboration suite for teams, it tries to facilitate knowledge sharing throughout the company by allowing people to find other employees who have the skills they currently require for their projects. Because of this, I would consider Connections to be a *knowledge sharing* system under the categories I specified in section 3.1..

When using Connections, an employee is required to create an extensive personal profile in which he is asked to provide any and all relevant information which may be of interest to colleagues within the company. Then, using this system, all users can search for colleagues who possess certain skills,

contacts or personal interests. In theory, this system should allow for a better transfer of tacit knowledge throughout the company by bringing people together (in one context or another) and thus facilitating social contact which in turn may lead to tacit knowledge sharing. Also, when setting up project groups or when certain expertise is required people may use Connections to find the appropriate personnel and contact them. To this end, blogging is also encouraged (and supported) on a Connections network as it allows people to quickly jot down ideas they might have come up with during the day, and by reading those blogs you might stumble onto people who share your ideas.

Another feature offered by Connections is the ability to organize your activities during the day and then share this and organize this with your co-workers. The sort of 'agenda' feature allows users to plan activities together, thus allowing them to improve their actual face-to-face social interaction which in turn allows them to more efficiently transfer and share knowledge. A rather big downside to this system is that it cannot be connected to your tasks as described in the Lotus Quickr system. This means that in essence you have to manage and maintain two separate agendas and task systems.

5. Case study definition

In this chapter I will describe the actual case study which I will perform in the GiPHouse company. I will describe the units relevant in this study, the variables relevant in this study and how I intend to measure them. The actual surveys used in this study can be found in the appendix; at the end of this document. Note that the methods used in defining this study are based on (Hart, Boeije, & Hox, 2007).

5.1. General description

In this practical case study I want to answer two of my research questions:

- How well is knowledge retention achieved by the system in use by GiPHouse
- How well is knowledge sharing achieved by the system in use by GiPHouse

To measure these two things, I first need to define units and variables for them. This will be done in section 5.2. and section 5.3.. For this study, I will base my measurement on 'user satisfaction'. In other words, I will measure the two units based on how the actual users judge the knowledge sharing and retention capabilities of the two systems in place at GiPHouse. To do this, a survey will be held among the *management* and *team members* of GiPHouse. For further information on this division, please read section 4.1.. I have chosen to separate these two groups because they depend on two different sets of company knowledge. The management users require knowledge on how to manage GiPHouse, solve problems among employees, manage finances, etc. The team members on the other hand are dependent on the knowledge concerning software development, customer interaction etc. How and when these two groups are separated will be further explained in section 5.3..

5.2. Units

The units in a study are fixed variables; i.e. things that are not dependent on any external circumstances and on which the survey itself has no influence. The units I define for this study are:

- **LQ ->Lotus Quickr.** The Lotus Quickr system in place at GiPHouse as described in section 4.2..
- **LC -> Lotus Connections.** The Lotus Connections system in place at GiPHouse as described in section 4.3..
- **GMM -> GiPHouse management.** The students who are currently fulfilling the roles of GiPHouse managers. Please note that for this unit the author of this thesis is excluded as this would pollute the study's data.
- **GTM -> GiPHouse team members.** The students currently fulfilling the role of team members in GiPHouse.

5.3. Variables

The variables in this study are defined by the research questions stated earlier. They are the actual things I will be measuring and are dependent on input from the actual GiPHouse employees. Please note that some variables are only relevant for management, others for team members and some variables are relevant for both. Another issue with this measurement is that all variables are

measured in a very limited scale. This is due to the fact that I want to keep things as simple as possible to make sure I stay within the boundaries (in terms of time and effort) set for this thesis.

By defining these variables I will create a blueprint for the survey since I will already have inventoried all information I have to gather.

- **EOUQ -> Ease of use for Quickr; {GMM, GTM},LQ -> {very difficult, somewhat difficult, neutral, somewhat easy, very easy}** (note: "Likert"-scale used here)
  This variable is used to measure the ease of use for the Lotus Quickr system. If a system is hard to use, then it will lessen its effect on knowledge sharing/retention since users will be reluctant to use it to its fullest. This variable is independent of the type of GiPHouse employee (management, team member).

- **EOUC -> Ease of use for Connections; {GMM,GTM},LC ->{very difficult, somewhat difficult, neutral, somewhat easy, very easy}** (note: "Likert"-scale used here)
  This variable is used to measure the ease of use for the Lotus Connections system. If a system is hard to use, then it will lessen its effect on knowledge sharing/retention since users will be reluctant to use it to its fullest. This variable is independent of the type of GiPHouse employee (management, team member).

- **AMUQ -> Amount of usage for Quickr; {GMM,GTM},LQ -> {never, sometimes, often, always}**
  This variable measures how much a user uses Quickr, measured on the users' perceived functionality of the system. For instance, if the user uses Quickr for all things the user believes Quickr is capable of, then the answer 'always' should be selected. The usage of the system is relevant to its capability to share/retain knowledge. If the system is not being used, then no knowledge is being stored or shared. This variable is independent of the type of GiPHouse employee (management, team member).

- **AMUC -> Amount of usage for Connections; {GMM,GTM},LC -> {never, sometimes, often, always}**
  This variable measures how much a user uses Connections, measured on the users' perceived functionality of the system. For instance, if the user uses Connections for all things the user believes Quickr is capable of, then the answer 'always' should be selected. The usage of the system is relevant to its capability to share knowledge. If the users do not use Connections to find people with the knowledge or experience they are looking for, then the system itself is not facilitating knowledge sharing. This variable is independent of the type of GiPHouse employee (management, team member).

- **AKAQ -> Amount of knowledge available on Quickr; GMM/GTM,LQ -> {none, some, most, all}**
  This variable measures how much knowledge is available compared to the knowledge requested by the user; in other words: Is the necessary knowledge available on Quickr. This

will give an indication on the functionality of the knowledge retention aspect of Quickr. For this variable I have decided to split to response group in management and team members since the sort of knowledge they require is different from each other.

- **AKCQ -> Amount of knowledge contributed to Quickr; GMM/GTM,LQ -> {0 templates, 1-5 templates, more than 5 templates}**
  This variable measures the amount of contributions made to the Quickr system in the form of task templates (see section 4.2. for more information). If users contribute no templates to the Quickr system, then no knowledge with regard to how to complete tasks is retained through the system. For this variable I have decided to split to response group in management and team members since the sort of knowledge they require is different from each other.

- **CPQ -> Connections Profile Quality; GMM/GTM,LC -> {no profile, basic profile, extensive profile}**
  This variable measures the quality of a Connections profile. The quality of a profile is important, because if there are very few high quality profiles available the overall usefulness of Connections with respect to facilitating social interaction (and thus tacit knowledge sharing) will be low. Note that the scale used is related to the way it works in Connections. A basic profile is just contact information, whereas an extensive profile also includes experience, skills, etc. For this variable I have decided to split to response group in management and team members since the sort of skills and experience they possess and may be looking for is different from each other.

- **SPSC -> Success per search for Connections; GMM/GTM,LC -> {never, sometimes, always}**
  This variable measures the amount of success the user perceives when searching for a colleague with specific knowledge or experience. If this is low, Connections does not facilitate sharing of tacit knowledge through social interaction very well; either due to the fact that user's do not upload a complete profile or because Connections is not easy to search. Please note that if the user never used this feature, I will request them to put in 'none' since that is a measure of quality for this variable. Furthermore, for this variable I have decided to split to response group in management and team members since the sort of knowledge they require is different from each other.

5.4. The survey

The survey used for my case study was sent to all employees of GiPHouse, management and team members. For both categories a different survey was sent and results will also be treated separately where applicable. The questions I have put in the survey are as follows:

1. How would you describe the ease of use of the Lotus Quickr system?

Very difficult ☐
Somewhat difficult ☐
Neutral ☐
Somewhat easy ☐
Very easy ☐

2. How would you describe the ease of use of the Lotus Connections system?

Very difficult ☐
Somewhat difficult ☐
Neutral ☐
Somewhat easy ☐
Very easy ☐

3. How often do you use Lotus Quickr? Note that I am interested in the usage with respect to the things you know you can do with Lotus Quickr. So for example, if you know the task system and use it all the time you should select 'always'.

Never ☐
Sometimes ☐
Often ☐
Always ☐

4. How often do you use Connections? Same conditions as question 3 apply.

Never ☐
Sometimes ☐
Often ☐
Always ☐

5. When you try to find a certain bit of information or template on Quickr, how much information do you find that is available?

None ☐
Some ☐
Most ☐
All ☐

6. How often have you put a new template on Quickr with information, a standard method to do something or a standard document format?

0 templates ☐
1-5 templates ☐
More than 5 templates ☐

7. How would you describe the quality of your Lotus Connections profile? Please note that the basic profile means contact information only, and the extensive profile means you have put all your working experience in the profile as well.

No profile ☐
Basic profile ☐
Extensive profile ☐

8. When you use Connections to find a person, how many times did you get a successful result? (i.e. you found a suitable person)

Never ☐
Sometimes ☐
Always ☐

The questions I will be treating per user group are questions 1, 2, 3 and 4 which corresponds to the definition of the variables I gave in section 5.3.. Please note that the actual surveys sent to the different groups are the same, but I will measure them differently. For more information I refer you to chapters 6 and 7.

6. Case study results

In this chapter I will review the results from the survey described in chapter 5. Please note that raw data only will be given in this chapter. The implications of the results will be discussed further in chapter 7 of this thesis. The final conclusion based on these results will be described in chapter 8.

6.1. Response

Before discussing the actual results from the survey, I will first discuss the response. The survey was held using an online tool (www.thesistools.com). Using this tools I could guarantee anonymity, a quick response and a control mechanism to check if people only filled out the survey once. Furthermore, an online survey is more accessible to most users since it requires the least amount of time and no offline interaction on their part. It was my hope that this would improve response by the users.

To inform the users of their requested participation in the survey I used the e-mail system employed by GiPHouse. The following table shows how many people were contacted and how many eventually filled in a survey form for both the management and team member category. All information is from the GiPHouse employment records.

Category	Amount contacted	Responses	Percentage
Management	19	11	57,9%
Team members	21	4	19,0%

Table 4 - Survey response

As you can see, the response from the management staff was more than 50%, which I find to be adequate. This may also be due to the fact that I have announced the survey on more than one occasion during GiPHouse management meetings.

The response from the team members however, is less than sufficient. Only 4 people have filled out the survey form, which is less than 20% and therefore not enough to draw conclusions from. For the purpose of this thesis I will still use the data gathered from the team members and draw conclusions from them, but I will not weigh them as heavily as the management's data. Unfortunately this is the only solution to this problem. Other solutions (such as promoting the survey again and wait for more results, or completely remove the team member population from the results) were considered and rejected due to a variety of reasons such as time constraints and the fact that it would require the entire research description to be altered and rewritten.

In a possible follow-up research I would recommend that the team members should be given special attention and that they be contacted as much as possible to get adequate results from them too since they form a substantial amount of the GiPHouse employee population and will probably have to use the system more intensively that the managers do.

6.2. Management results

The results of the survey will be expressed numerically and visually. The visual representation is valid here since the questions were asked in such a way that the results were always corresponding the index of the answer. In other words, the first possible answer would always indicate a bad usage of the system, while the last possible answer would indicate good usage of the system.

Question 1 - How would you describe the ease of use of the Lotus Quickr system?

Very difficult	2
Somewhat difficult	3
Neutral	3
Somewhat easy	3
Very easy	0

Table 5 - Answers management question 1

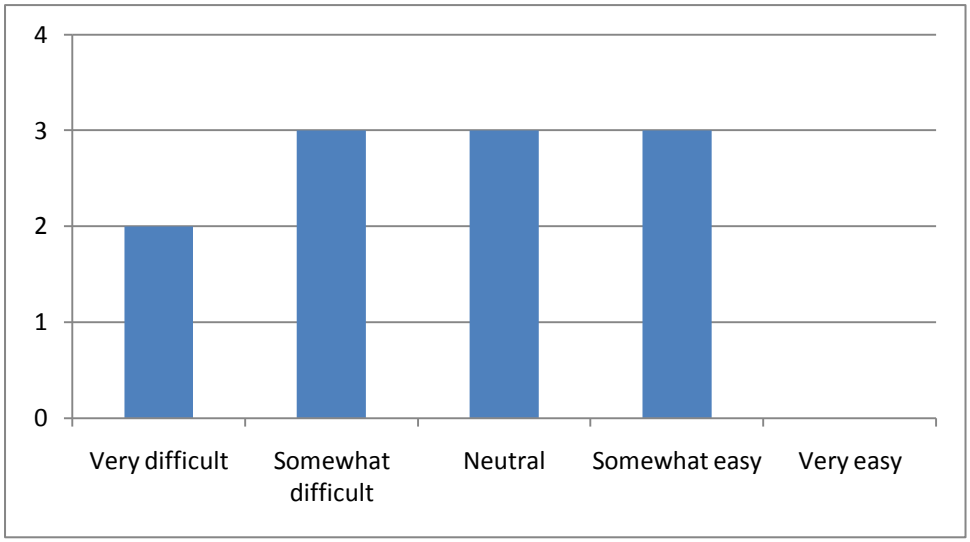

Figure 4 - Answers management question 1

Question 2 - How would you describe the ease of use of the Lotus Connections system?

Very difficult	2
Somewhat difficult	3
Neutral	6
Somewhat easy	0
Very easy	0

Table 6 - Answers management question 2

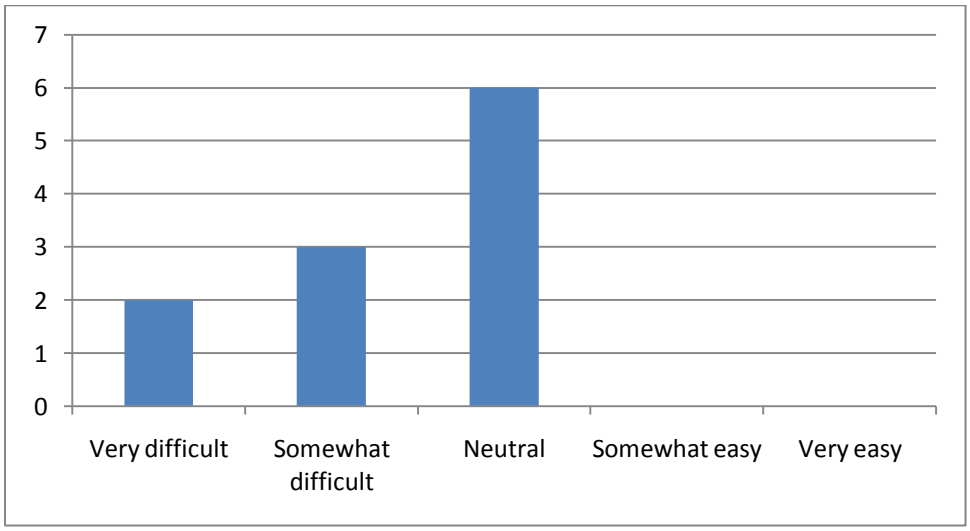

Figure 5 - Answers management question 2

Question 3 - How often do you use Lotus Quickr?

Never	0
Sometimes	7
Often	3
Always	1

Table 7 - Answers management question 3

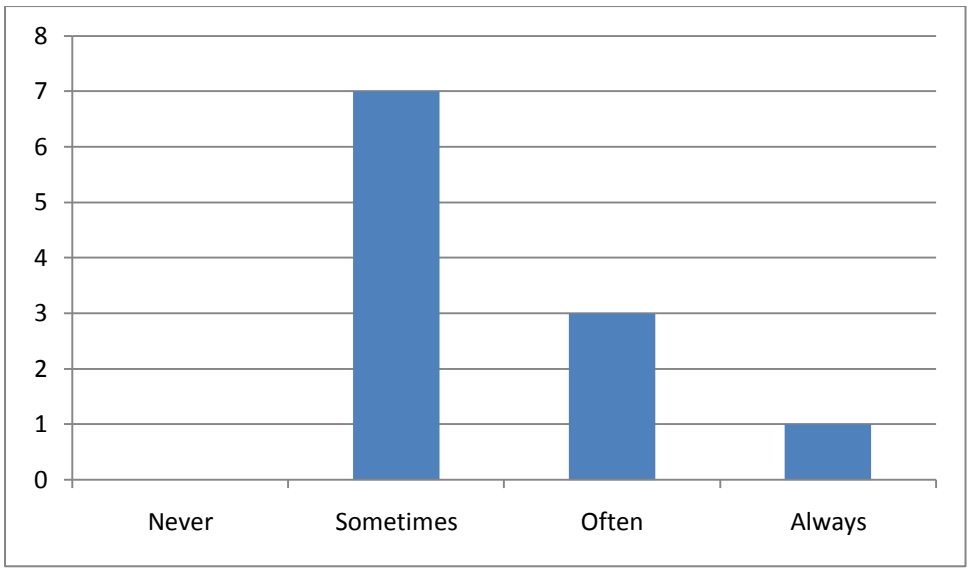

Figure 6 - Answers management question 3

Question 4 – How often do you use Lotus Connections?

Never	6
Sometimes	5
Often	0
Always	0

Table 8 - Answers management question 4

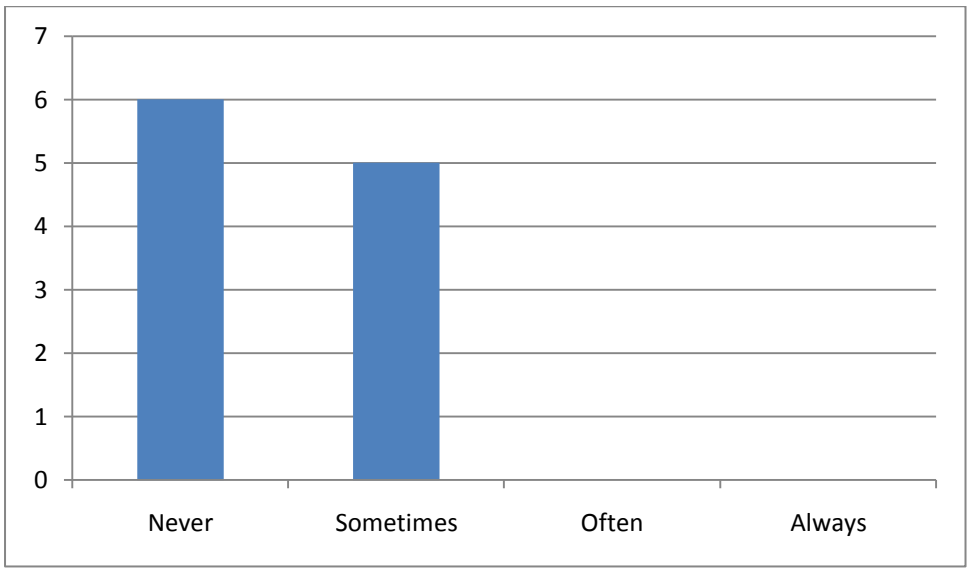

Figure 7 - Answer management question 4

Question 5 – How much of the information relevant to you is available on Quickr?

None	0
Some	8
Most	3
All	0

Table 9 - Answers management question 5

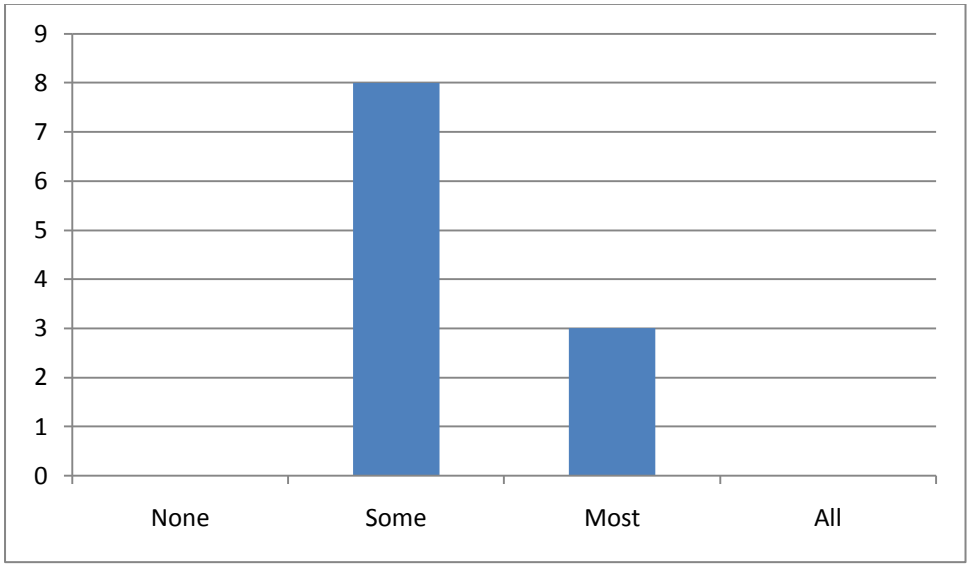

Figure 8 - Answers management question 5

Question 6 – How many new templates (= standard method to perform tasks) have you added to Quickr?

None	7
1 to 5	3
more then 5	1

Table 10 - Answers management question 6

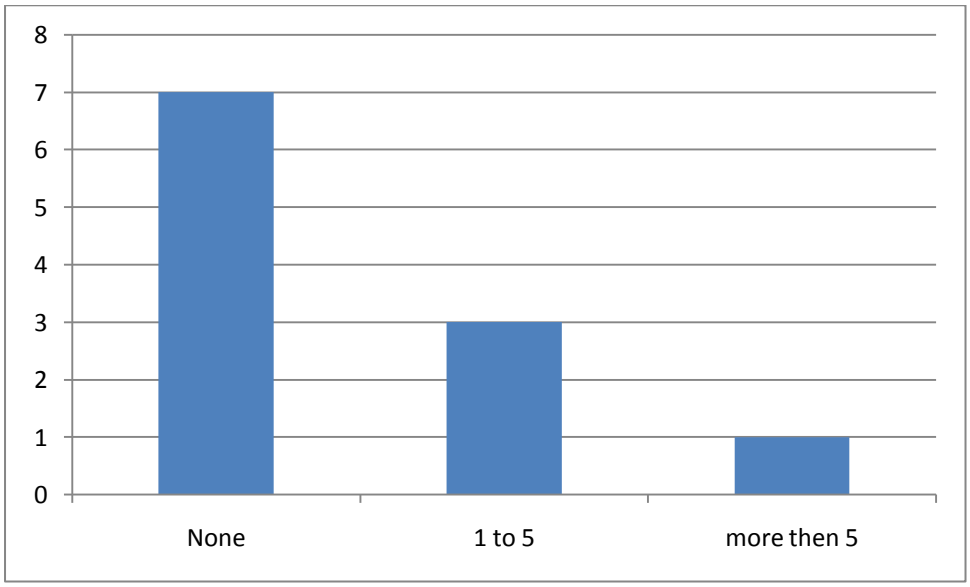

Figure 9 - Answers management question 6

Question 7 – What is the quality of your Connections profile?

No profile	7
Basic profile	2
Extended profile	2

Table 11 - Answers management question 7

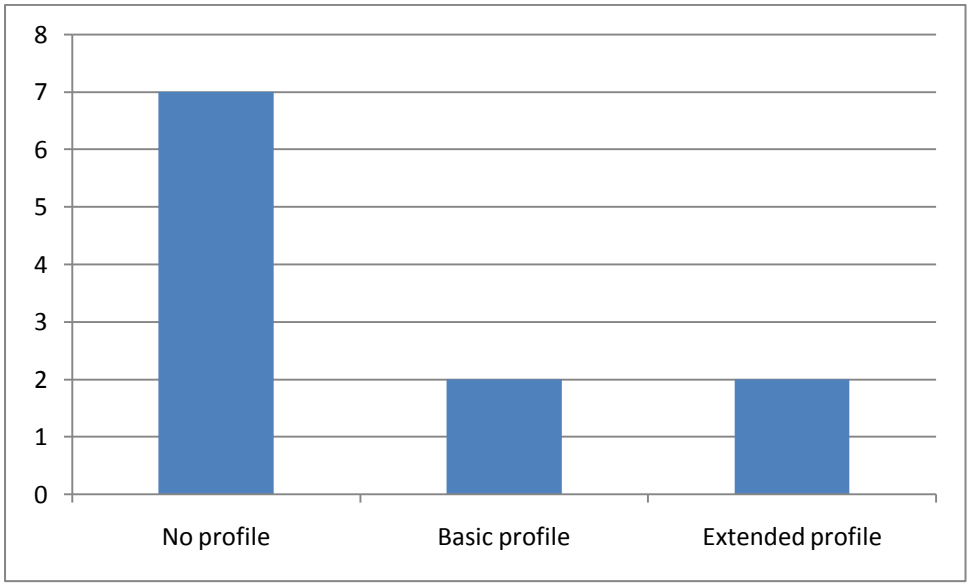

Figure 10 - Answers management question 7

Question 8 – How often do you get relevant results from a Connections profile search?

Never	7
Sometimes	4
Always	0

Table 12 - Answers management question 8

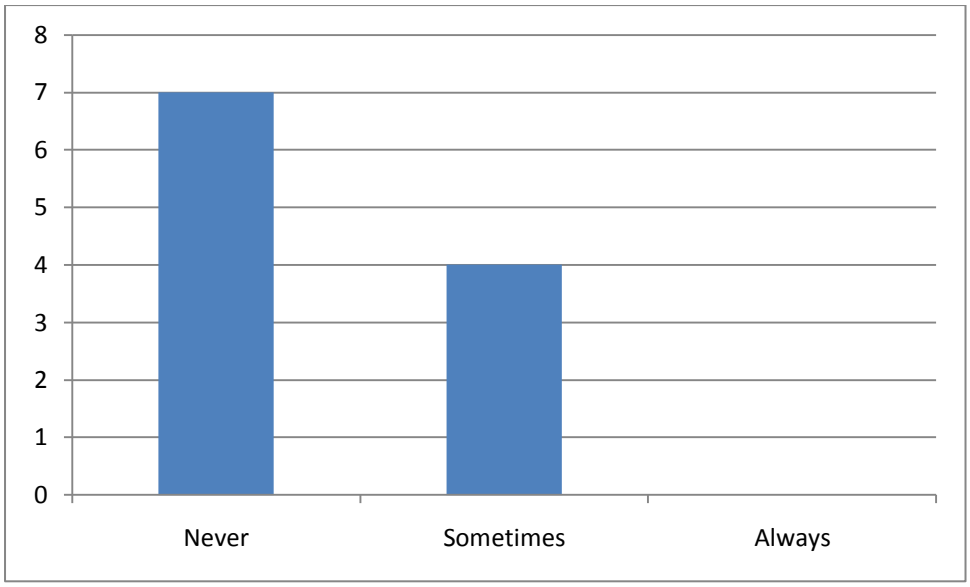

Figure 11 - Answers management question 8

6.3. Team member results

As I have stated before, there are only very little amount of team member results available (n=4). All other statements made in 6.2. also apply to these results however.

Question 1 - How would you describe the ease of use of the Lotus Quickr system?

Very difficult	1
Somewhat difficult	2
Neutral	0
Somewhat easy	0
Very easy	1

Table 13 - Answers team members question 1

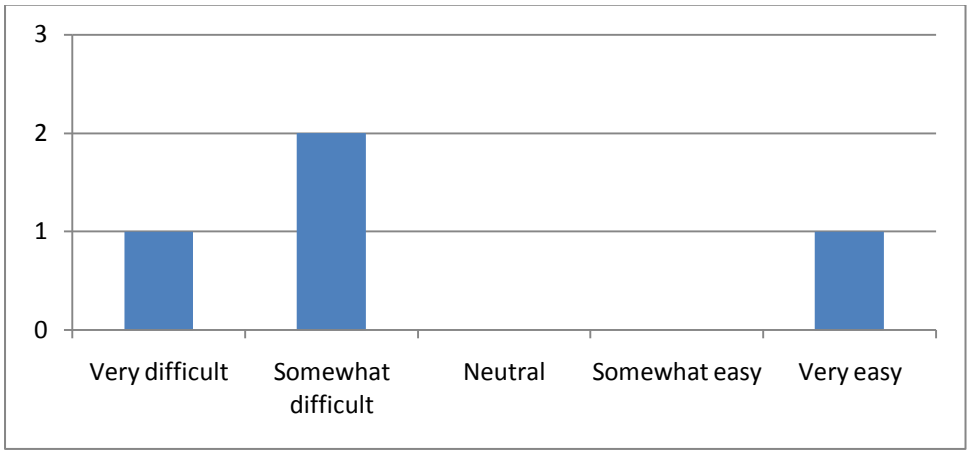

Figure 12 - Answers team members question 1

Question 2 - How would you describe the ease of use of the Lotus Connections system?

Very difficult	2
Somewhat difficult	0
Neutral	1
Somewhat easy	1
Very easy	0

Table 14 - Answers team members question 2

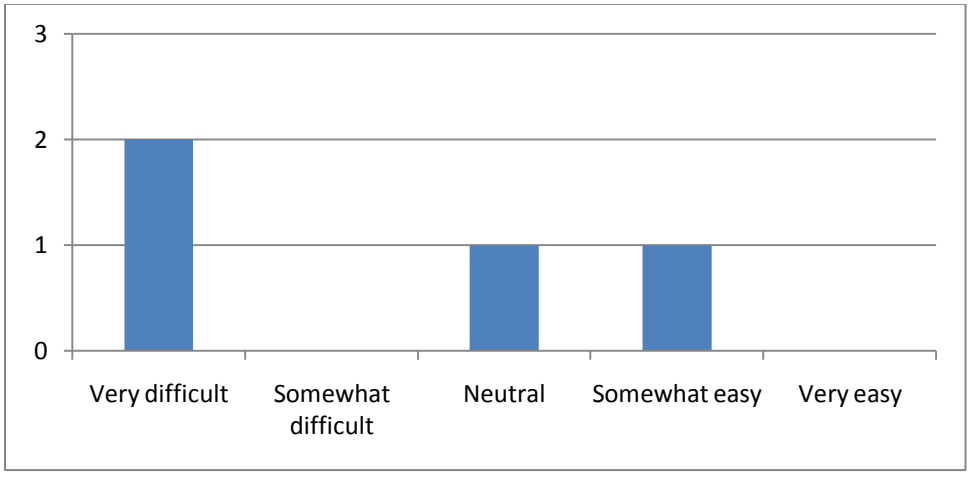

Figure 13 - Answers team members question 2

Question 3 - How often do you use Lotus Quickr?

Never	1
Sometimes	1
Often	2
Always	0

Table 15 - Answers team members question 3

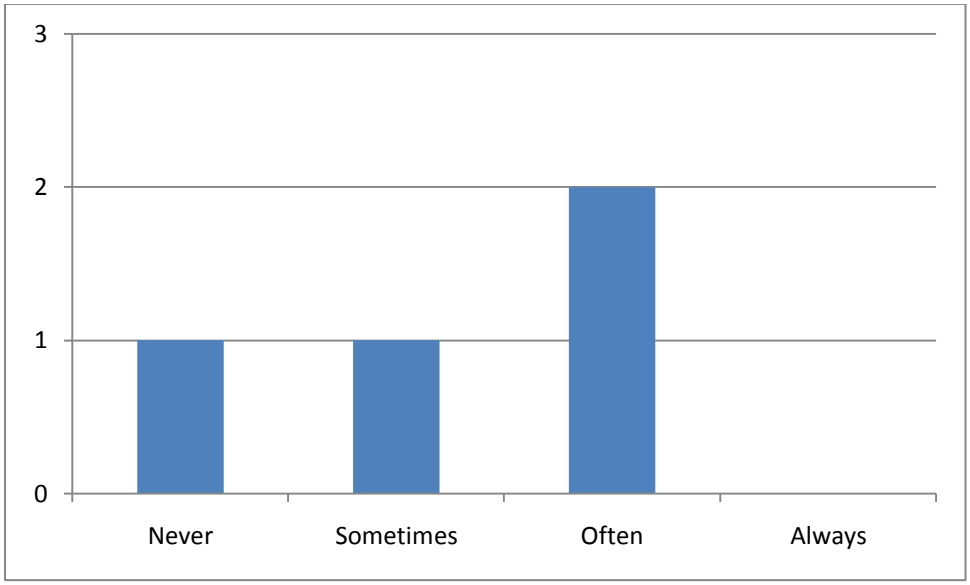

Figure 14 - Answers team members question 3

Question 4 – How often do you use Lotus Connections?

Never	3
Sometimes	0
Often	1
Always	0

Table 16 - Answers team members question 4

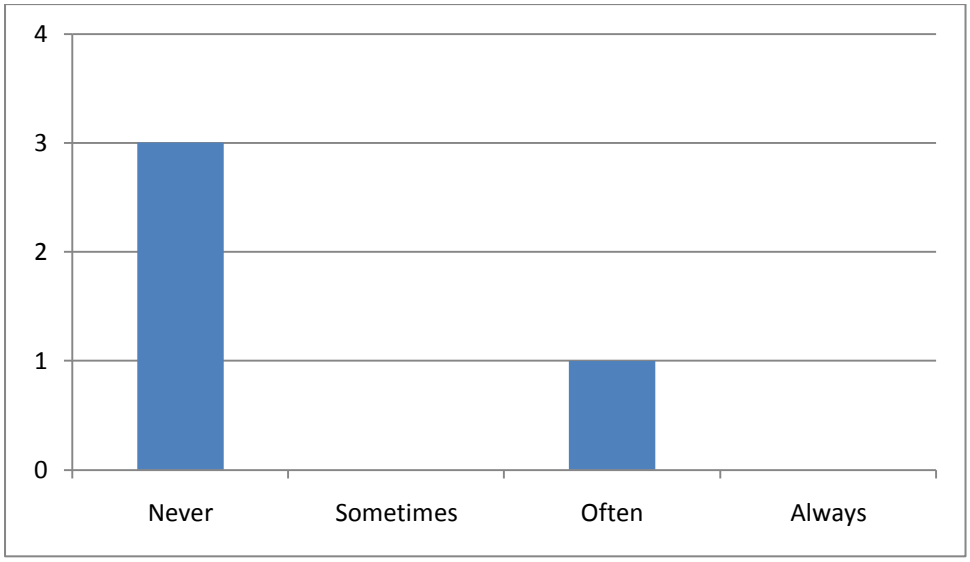

Figure 15 - Answers team members question 4

Question 5 – How much of the information relevant to you is available on Quickr?

None	0
Some	4
Most	0
All	0

Table 17 - Answers team members question 5

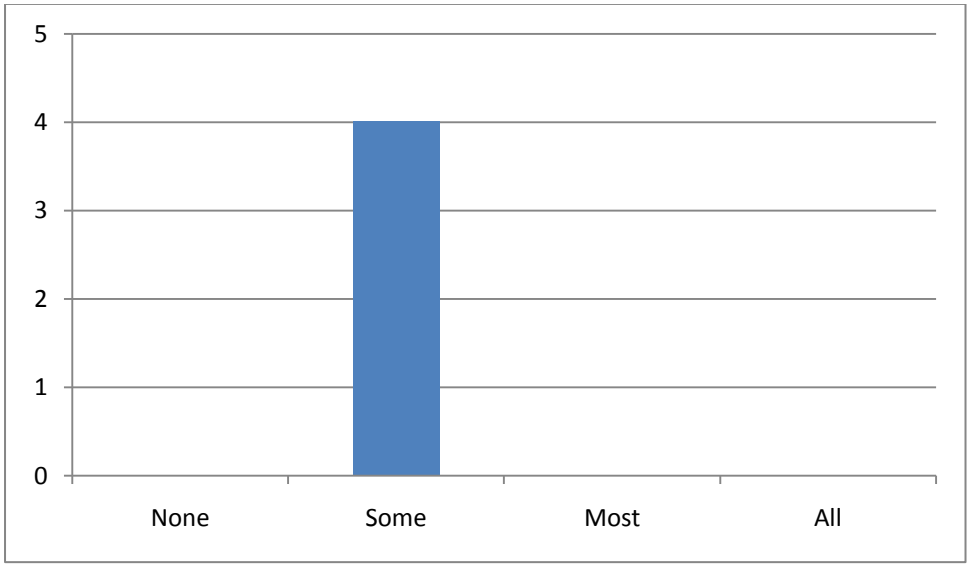

Figure 16 - Answers team members question 5

Question 6 – How many new templates (= standard method to perform tasks) have you added to Quickr?

None	2
1 to 5	2
more then 5	0

Table 18 - Answers team members question 6

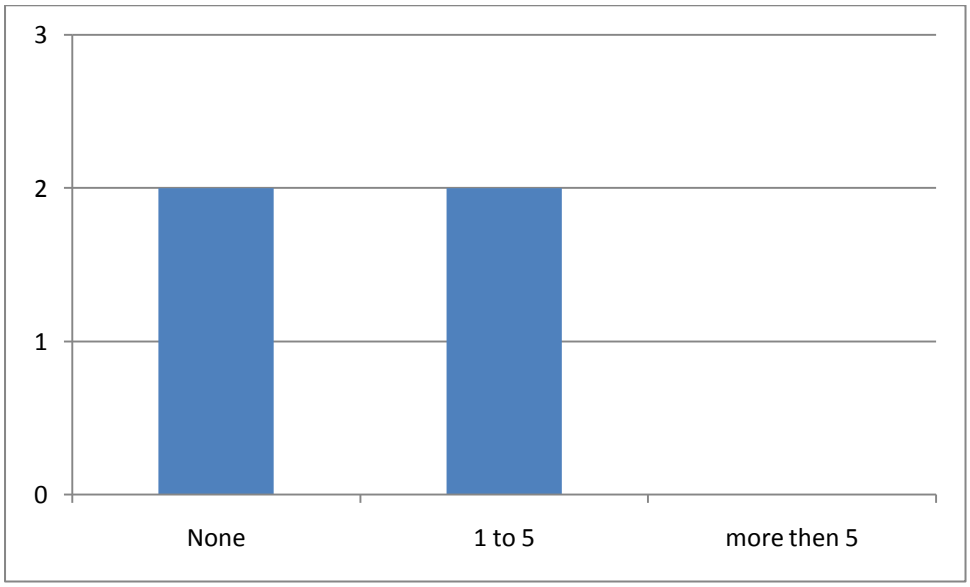

Figure 17 - Answers team members question 6

Question 7 – What is the quality of your Connections profile?

No profile	3
Basic profile	1
Extended profile	0

Table 19 - Answers team members question 7

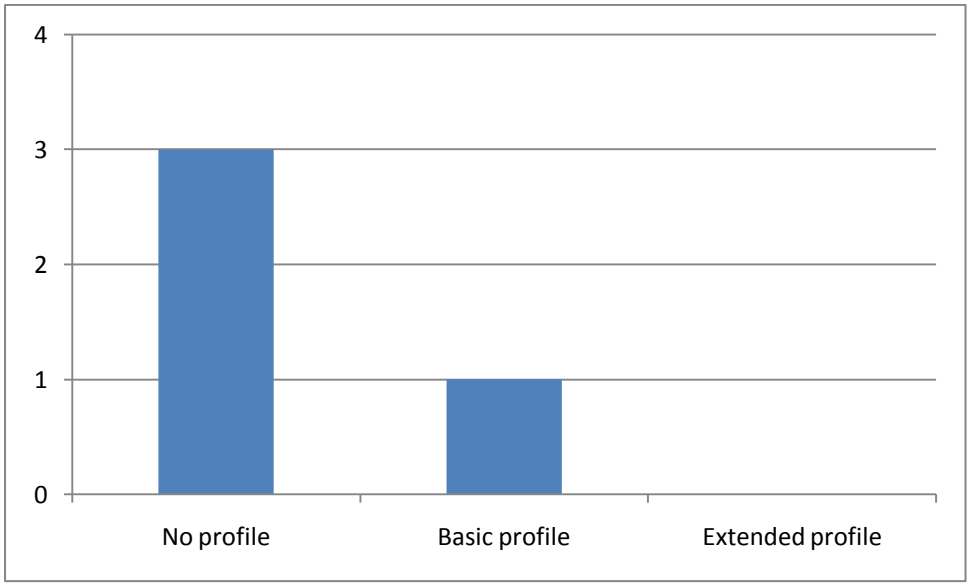

Figure 18 - Answers team members question 7

Question 8 – How often do you get relevant results from a Connections profile search?

Never	4
Sometimes	0
Always	0

Table 20 - Answers team members question 8

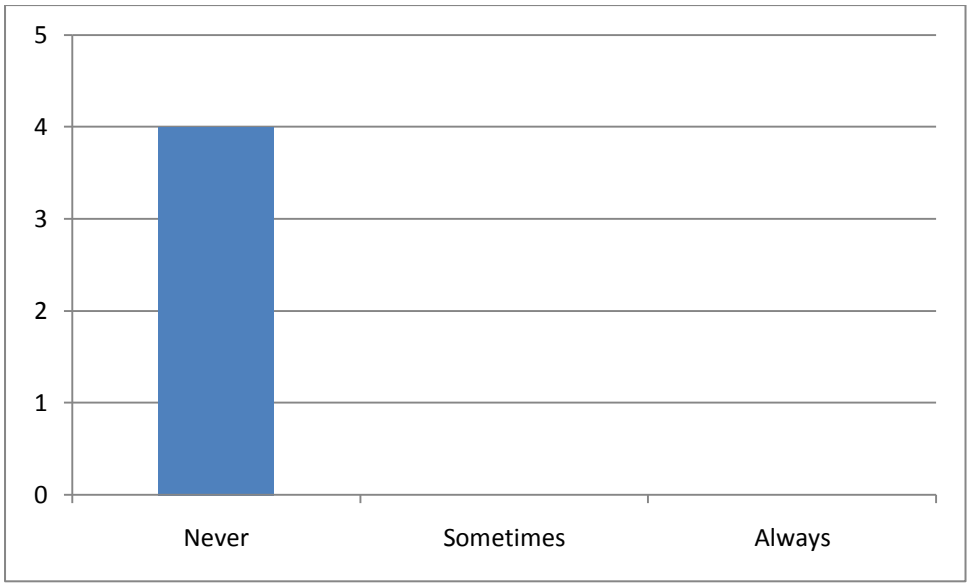

Figure 19 - Answers team members question 8

7. Evaluating the case study results

In this chapter I will evaluate the results I have gotten from the survey. This evaluation will include the identification of problems, both from the managerial and team member perspective. Please note that the evaluation will be on a per question basis to evaluate the variables identified in chapters 5.2. and 5.3.. For a complete evaluation of the system in place at GiPHouse based on these results please see chapter 8.

7.1. From a general perspective

The results with respect to the performance of the system based on the specifications I gave in chapter 4.2. and 4.3. are not very encouraging. The first question was about the ease of use of the Lotus Quickr system. The results indicated that most people find it rather hard to use the Quickr system. This would indicate that the knowledge sharing and retention capabilities that exist within the system are not fully utilized since the users apparently cannot easily access and use the system. This can have a variety of reasons such as poor training from GiPHouse's side or poor implementation from IBM's side. To resolve this issue, further training or design is required to make the Quickr system easier to use for the managerial staff of GiPHouse.

For team members, ease of usage seems to be even worse; but I again remind you of the very limited data available on team members. The same recommendations and reasons seem to apply for the team members as they do for the managers.

The second question is about the ease of use of the Connections system and results appear to be a little bit better. However, we must keep in mind that (looking a bit ahead) question 4 indicates that most people rarely use Connections. This means that some of the users may have chosen the 'neutral' answer since they feel that not using Connections warrants this answer. In retrospect; should have been asked in a different way; but at least we can conclude that the overall ease of use of the Connections system is also leaning towards the negative side. The same possible reasons as Quickr apply here: poor training or poor design. It may also be resolved by training people better or improving the application itself.

Question three refers to the usage of Quickr. The results here are more positive since apparently all managers use the Quickr system. On a side note however, most of the users selected 'sometimes' as the most appropriate answer which still does not mean that they actually use the system to its fullest. We can conclude however, that since Quickr is being used by the employees, it does serve its purpose of facilitating the sharing of explicit knowledge between the employees of GiPHouse. A possible reason for the widespread usage of Quickr is the aggressive marketing done by the GiP directors and the semi-mandatory usage of the system by both management and team members.

The fourth question referred to the usage of Lotus Connections. From the results we can conclude that this is very poor. Nearly all users indicated that Connections is rarely or never used. This means that Connection's primary goal, facilitating user interaction to share (tacit) knowledge, can never be fully realized within GiPHouse. We can identify two possible reasons for that. The first being that the upper management does not place enough emphasis on the usage of Connections. If this is the case, than a 'marketing' campaign similar to the one in place for Lotus Quickr might solve this problem. Another reason may be the relative small size of the GiPHouse company. Considering that only 40 people work in GiPHouse at any given time, and that all these people work in one geographical

location the Connections system may be a bit superfluous. This could mean that social interaction to share knowledge is already facilitated by other (social) means; however this is not covered in the scope of this thesis.

7.2. Management specific results

The fifth question of the survey related to the amount of knowledge available on the Lotus Quickr system to help the management complete their day-to-day jobs. Before I discuss the results I would first like to emphasize that transferring knowledge (in any form) from one semester to the next is a very difficult problem for GiPHouse to solve. In this semester (spring, 2008-2009) there were considerable startup problems; most of them related to managers not knowing what their exact roles entailed. At that time, the Quickr system was mostly empty or inaccessible meaning that at that moment the available knowledge was practically zero.

Now, three months later the results are more encouraging. To question five most managers answered that at the very least some information is available on the Quickr system, and that for three of them most information was available on Quickr. This is a good sign since it means that Quickr is facilitating knowledge sharing and retention. Assuming that the Quickr system keeps running until the next semester we can conclude that the management for that semester will have an easier time finding the information they need.

Question six refers to the amount of new templates (default methods to perform tasks) created by a manager. According to the results, there are a couple of managers create all the new standards (and thus sharing knowledge) while most manager do not seem to do this at all. This may be explained by the fact that there is a so-called quality management who are responsible for creating default templates for all management functions. They are probably the managers responsible for the high results in the survey, but this is inconclusive. A problem, however, is that this practice leads to a new problem; namely that all knowledge on Quickr is now created by a very limited number of sources which implies that the knowledge is not objective and not subject to peer review. As a result, the knowledge may be flawed or incomplete. GiP management should change their policy and encourage all managers to create templates based on their own roles. This should improve knowledge diversity and the overall quality of the knowledge and procedures presented.

The seventh question refers to the quality of the Connections profile. As we have seen before, usage of Connections is very limited and this is again reflected in the quality of the Connections profile. Most users have no Connections profile at all, two have a basic profile (which contains contact information only) and only two have an extended profile which contains all relevant data about experience, contacts, etc. This means that not only do people not use Connections, they could not if they wanted to. Managers could search for expertise as much as they want, but they would not be able to find anything since there are very few profiles to actually search. This too should be solved by encouraging the usage of Connections and to persuade or force people to create Connections profiles. If they would do so, the managers in the next semester would also be able to find their predecessors and ask them about the problems facing that specific managerial role.

In view of the results of question 7, question 8 is no longer relevant. Since there are only very few profiles available on Connections, it is very unlikely that people will be able to perform a successful profile search on Connections. This is confirmed by the results as 7 people never found a contact on Connections, and 4 people sometimes found a required person on the Lotus Connections system.

This also means that the function of Connections (facilitating social interaction and thereby increase knowledge transfer) is again not fulfilled.

7.3. Team member specific results

As stated several times before, I have only gathered very few results from team members. Therefore, I will only draw very limited conclusions from the questions, and only if most of the responders are more or less in agreement. I would like to state that if a follow up investigation is done based on my work (to ascertain performance in the next semester) that these results are to be disregarded as they may not be representative for most of the team members working in GiPHouse.

Question five was about the amount of information available for the team members to do their jobs. This information includes contact information, manuals for the tools they use, etc. All 4 team members agreed on the fact that some information is available. The survey does not show what information is lacking, but an often heard complaint is that there are no templates available for the various documents which have to be delivered by the team members. This may be solved by the current team members themselves; they could use the Quickr system to design and implement various templates.

The sixth question refers to the amount of templates created on the Quickr system. For team members, templates mostly include ways to perform things like requirements gathering, developing a formal technical design, etc. However, the results on this question are inconclusive since 2 team members indicated that they did not make any templates, and the other 2 indicated that they had made 1 to 5 templates over the course of this semester. Since four people is not enough to draw conclusions from we can only theorize about a conclusion. One such conclusion is that not many templates are being made by team members at the moment. This could be solved by GiPHouse management by encouraging the creation of templates, as well as informing team members of the importance of creating best practice documents for both themselves and other team members.

Question seven, about the quality of the Connections profile, again follows the results we have already observed in question four: Connections is rarely used at all. This conclusion was true for the managers, and from what little data we now have about the team members it would seem that the conclusion for them is valid as well. Most team members (three out of four) indicated that they did not create a Connections profile at all. Only one team member indicated that he at least had a limited profile available on Connections. This seems to be concurrent with the manager's position on the system, and therefore the same recommendations apply: GiPHouse management should try to improve the usage of the Connections system and encourage people to fill out their personal profile.

The eighth question again supports the conclusion made before: None of the team members who filled out the survey have ever made a successful search in the Quickr database. In other words, the knowledge sharing facilitating potential of Connections is not used at all by the team members.

8. Final conclusion and recommendation

In this chapter I will summarize the answer to all the research question stated in chapter 1. This should lead to the answer to the main research question. Finally, I will give a recommendation to GiPHouse which can be used to improve the facets of knowledge management and knowledge sharing using the systems they have.

8.1. The research sub-questions

- **How can knowledge be defined?**
  Knowledge can be defined according to a number of perspectives. The perspective I used throughout this thesis is the practice-based approach on knowledge. This means that we define a difference between explicit and tacit knowledge. Explicit knowledge is knowledge that is easily codified; for example the instruction manual of a television. Tacit knowledge is a person's knowledge on how to perform a certain task; or rather: skills. Skills cannot be codified but have to be shared by social interaction. There is no clear boundary where explicit knowledge ends and tacit knowledge begins. Rather, there is a sort of grey zone where parts of knowledge are explicit and other parts are tacit. A detailed description on knowledge in general may be found in section 2.1..

- **What is the definition of knowledge retention in a general context?**
  Knowledge retention is about saving the knowledge generated in your organization; even when the people possessing the knowledge leave the organization. Knowledge retention may be accomplished by IT systems or people management, but always has to be facilitated on multiple levels to be successful. The extended answer to this question and more information on the subject of knowledge retention can be found in section 2.5..

- **What is the definition of knowledge retention in the GiPHouse context?**
  For GiPHouse, knowledge retention is very important when looking at its organizational structure. Every single semester, the entire management and team member groups completely change; there are no people who cross over from one semester team to the other. This means that if knowledge retention in GiPHouse is not properly facilitated it will lead to very serious problems at the start of each semester (something that has been observed a couple of times already). With an adequate knowledge retention system in place, GiPHouse will be able to keep knowledge gained in previous semesters and quickly distribute it to the new members. For more information please take a look at chapter 4.

- **What is the definition of knowledge sharing in a general context?**
  Knowledge sharing is about sharing knowledge between people in an organization. Knowledge sharing may be facilitated by any number of systems, including social interaction, human resource management and IT systems. When sharing knowledge, people will be able to use other people's knowledge to further improve their own knowledge about certain subjects, as well as preventing those people from having to invent the wheel again. More information on this subject can be found in sections 2.2, 2.3. and 2.4..

- **What is the definition of knowledge sharing in the GiPHouse context?**
  Knowledge sharing for GiPHouse is primarily about sharing best practices. This is true for

managers and team members. Templates are used to specify how certain operations and tasks have to be fulfilled and how certain documents have to be delivered. Team members can to share knowledge on how to tackle difficult technical problems. More information on this may be found in chapter 4.

- **How can knowledge sharing be measured in the GiPHouse context?**
  Knowledge sharing can be measured in a number of ways, but in this case I have decided to use user input. By performing surveys on specific subjects I can measure a few things on the efficiency of knowledge sharing in GiPHouse. However, since I am using user input this may not be completely objective and this has to be taken into account when drawing conclusions from the results. The variables used to measure knowledge sharing may be found in sections 5.2. and 5.3.. The survey itself may be found in 5.4.. Please note that the survey itself was performed online and the layout of the survey might be slightly different from the example shown in 5.4..

- **How can knowledge retention be measured in the GiPHouse context?**
  As with knowledge sharing, I have decided to use surveys to gather my data so all further information is the same.

- **How well is knowledge retention achieved by the system in use by GiPHouse?**
  Knowledge retention in GiPHouse is not what it could be, but it is rather efficient. The biggest problem here is that the systems in place are not properly utilized by the GiPHouse employees. Lotus Quickr is now used as a data repository, and efforts are being made to codify their knowledge but it is currently being done by two specific people. To optimally use the system, all management and team member roles within GiPHouse should manage their own knowledge through the system and create their own best practice templates on Quickr. Furthermore, the system should be utilized more by GiPHouse employees to actually make use of the data currently in place. As it is, all knowledge is generated by one single party (the GiPHouse Quality Management) and is therefore not representative for all roles. For more information and detailed survey results, please see chapter 7.

- **How well is knowledge sharing achieved by the system in use by GiPHouse?**
  The knowledge sharing system in place at GiPHouse is being poorly used. Lotus Connections has the capability to facilitate knowledge sharing by improving contact between employees using their extended profiles. However, as nearly no one even has an extended profile and even fewer people actually use the system, this functionality is not being used. This is a shame as it would help team members get in touch with the managers and solve a lot of the common problems currently in place at GiPHouse. Another issue is that Lotus Connections is being perceived as a complicated system. This is something GiPHouse obviously cannot solve, but it might be a good idea to look for other systems to use instead of Lotus Connections. Furthermore, the top management should stimulate the use of the Connections system as it would help them to integrate new employees in GiPHouse and solve the communication problems that currently exist within GiPHouse. More information and detailed survey results may once again be found in chapter 7.

8.2. Conclusion

GiPHouse has two major systems in place to facilitate their knowledge sharing and retention: Lotus Connections and Lotus Quickr. These systems on itself seem to be capable of performing the tasks laid out for them (even in the GiPHouse context) and are currently in use in multiple organizations throughout the world. Furthermore, GiPHouse is in need of these systems given their rather unique organizatorial situation and the problems they face at the start of each semester. It could help them to streamline their organization and improve productivity. By sharing explicit knowledge through Lotus Quickr and facilitating tacit knowledge sharing between employees through Lotus Connections the knowledge situation in GiPHouse would be greatly improved.

However, a big problem faced with the use of these systems is the fact that the upper management is doing a poor job in actually promoting the use of these systems and creating the correct organizatorial environment in which to optimally use the systems provided. Both managers and team members are not motivated to use and to contribute to the systems, which leads to poor performance from the system itself. Furthermore (for Lotus Quickr), only a handful of people are currently contributing knowledge for the entire system; even for the employee roles with which they have no experience at all! This leads to faulty and not up-to-date knowledge being placed on the system which in turn leads to bad performance in terms of knowledge sharing.

The Lotus Connections system is even worse: it is currently not being used at all in any sense of the word. Therefore; its goal of facilitating knowledge sharing is not reached at all. With no extended profile (or in most cases even basic profile) available, Connections does not contribute to knowledge sharing at all.

8.3. Recommendations

To conclude this thesis I will put forward some recommendations which may help to improve the knowledge sharing/retention aspect of the GiPHouse organizations. These recommendations are based on the answers to the research questions as given in section 8.1..

- **Find ways to motivate employees to contribute to Quickr**
  If the management staff of GiPHouse contributed more information to Quickr, more knowledge would be retained for the coming semesters and as a result, the performance for Quickr would increase and the first weeks of a new semester would run smoother; it helps people to avoid making mistakes from the past.
  If the team members contributed to Quickr, coming teams would be able to learn how what documents are expected of them, what a certain document should contain, where to find relevant information, etc. This could improve their performance.

- **Find ways to motivate employees to use Connections**
  If the GiPHouse management at least made creating an extended profile mandatory, then Lotus Connections would become a usable tool in finding colleagues with the required knowledge. This is turn could automatically promote Connections' usefulness and lead to better knowledge sharing.

- **Do not allow employees to place 'second hand knowledge'**
  Currently only one management group (quality management) is creating all templates for use

within GiPHouse. This should be changed to improve the quality of Quickr's knowledge. Templates should be created by the people who use them, and not people who think they know how to use them. Quality management should only be responsible for verifying the 'look-and-feel' of such templates to make sure they conform to GiPHouse standards. All contents should be created by the responsible employee role.

- **Improve training for the systems**
  One of the results of the survey is that a lot of people did not find it easy to use Quickr and Connections. This could be (partially) resolved by increasing the amount of training for the employees in the use of the systems. When people are more comfortable with using the systems usage may be increased and the full functionality of the system may be better utilized.

9. Literature

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