Graduation Thesis

Managing Tacit Knowledge in Hospitals
Successfully Delivering the Intangible with IT

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Summary
Summary

Hospitals in The Netherlands are under pressure to improve the efficiency and quality of patient care. Knowledge management and Information Technology (IT) enable hospitals to meet these objectives. The hospital is characterized by the knowledge that is needed for the execution of the primary processes. This knowledge allows professionals to deliver efficient and high quality care. IT systems can play an important role in facilitating knowledge management. However, not all knowledge can be made explicit. A significant part of the knowledge exists inside the human mind. This tacit knowledge plays a significant role in health care processes. Tacit knowledge can only be made explicit under some conditions. Once we understand these conditions, we can explore the possibilities for knowledge management. This study aims to find out how hospitals can manage tacit knowledge through IT systems.

To answer this question a number of steps are taken. Using literature, a theoretical problem exploration provides concepts for managing tacit knowledge through IT systems. Important concepts deal with the organizational and technical complexity of the hospital, the differences between three actor perspectives (management, professionals and nurses), and the components of the knowledge environment (organizational structure, competences, culture and systems).

Based upon the concepts explorative case studies have been executed in two hospitals: (1) The Leids Universitair Medisch Centrum (LUMC) and (2) the Medisch Centrum Rotterdam–Zuid (MCRZ). The LUMC is, as an academic hospital, further in IT supported processes than the general hospital MCRZ, but neither of them implemented knowledge management solutions. Using interviews with actors representing managers, professionals and nurses investigation is made of:

- Requirements for how tacit knowledge should be managed in the future hospital;
- Obstacles that make it complicated to reach this;
- The experiences in dealing with these obstacles.

Analysing the interviews reveals how large obstacles have prevented both hospitals from implementing useful tacit knowledge management and IT solutions and how this can be linked with literature. The large distance between actors is just one of the many reasons why IT projects have failed. The benefits of IT projects are often invisible to the end–users. End–user involvement and awareness of the organizational needs are necessary when implementing new solutions.
Summary

On top of this analysis appears the conclusion that hospitals at this moment should not manage tacit knowledge through IT systems. Hospitals should however manage tacit knowledge differently and measures for this are recommended. In addition, hospitals should increase the use of IT systems for the exchange of information and explicit knowledge. By improving the use of tacit knowledge management and IT systems separately, the possibilities to combine tacit knowledge management and IT systems can be reconsidered in two to three years. Meanwhile, further research can gain more insights into this subject.

The potential benefits of tacit knowledge management through IT systems are clear, but the obstacles are currently too high. The hospitals can prepare themselves, by starting with tacit knowledge management and increasing the use of IT systems. Through these changes a more efficient hospital can be reached, which delivers higher quality.
Preface

During the last six months, I gathered a large amount of insights in health care processes, hospital organizations and the role of tacit knowledge to complete my graduation project. This project was the final project in the Master of Science study Systems Engineering, Policy Analysis and Management (SEPAM) at the faculty of Technology, Policy and Management (TPM) of the Delft University of Technology (TU Delft). With the completion of this project, I have finished this five-year study (including the Bachelor of Science Technische Bestuurskunde) and a time of working, fun and studying at the university.

This research would not have been realized without the support of many people around me. Especially, I would like to mention my great graduation committee, Hans de Bruin, Haiko van der Voort, Desiree Hoving and last but not least Robert van Oirschot, my supervisor from Alares. Special thanks go to my colleagues at Alares, where I conducted my research: Ed Magnée, Annemiek de Meulmeester, Harry Kotey, Wilko van Oosten, Erik Soonieus, Natascha Walpot, Marianne van Teunenbroek, Josine Krispjin, Violette van Gisbergen and Ronald van Zuijlen.

This research would not have been possible without the commitment of the respondents at the two hospitals. I am very thankful to their cooperation and great remarks. In the MCRZ, I got a warm welcome from Mark van Aart, who helped me interviewing Paul Smits, Rob Stevens, Frank Arnoldy, Tjeerd Canrins, Jeanet van der Stel, Cees van Donselaar, Tobias Bruning, Frederik Santman, Ronald van der Lely en Teng. At the LUMC, Robert Holl and Karel van Lambalgen saw the potential of this research. Here, I interviewed further Erik Flikkenschild, Hans van Raamt, Joan Meekel, Caroline de Bes, Marlies Lagendijk, Lenneke Elderbroek, Martine de Clercq, Barbara Romsom, Fennate Huiberts, and Eveline van Roon.

Relevant information has been gathered from Hans Koller (De Waerden), Hans van der Krogt (UMCG), Daniëlle Smolders (TUE), Marita Dogterom (Ziekenhuis Dirksland), Hans Haverman (Ministerie van VWS). Special help in the beginning of the project did I get from: Katie Waling (Heemzicht), Robert Verburg (TU Delft) and Marijn Janssen (TU Delft).

Finally, I would like to thank my lovely Anna and my family Henk, Marianne and Geerten.

Laurens Waling
Delft, 15 July 2006

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## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUMMARY</td>
<td>III</td>
</tr>
<tr>
<td>PREFACE</td>
<td>V</td>
</tr>
<tr>
<td>CONTENTS</td>
<td>VII</td>
</tr>
<tr>
<td>TABLES AND FIGURES</td>
<td>IX</td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1. Preliminary research question</td>
<td>1</td>
</tr>
<tr>
<td>2. THEORETICAL PROBLEM EXPLORATION</td>
<td>3</td>
</tr>
<tr>
<td>2.1. The hospital as a complex knowledge based organization</td>
<td>3</td>
</tr>
<tr>
<td>2.2. Knowledge management</td>
<td>5</td>
</tr>
<tr>
<td>2.3. Hospital actors and knowledge management</td>
<td>12</td>
</tr>
<tr>
<td>2.4. The role of IT in managing the intangible</td>
<td>18</td>
</tr>
<tr>
<td>2.5. Where is the limit?</td>
<td>23</td>
</tr>
<tr>
<td>2.6. Problem demarcation and statement</td>
<td>24</td>
</tr>
<tr>
<td>3. RESEARCH APPROACH</td>
<td>27</td>
</tr>
<tr>
<td>3.1. Sharpened research question</td>
<td>27</td>
</tr>
<tr>
<td>3.2. Research method</td>
<td>28</td>
</tr>
<tr>
<td>3.3. Research objectives</td>
<td>29</td>
</tr>
<tr>
<td>3.4. Case studies</td>
<td>30</td>
</tr>
<tr>
<td>3.5. Interviews</td>
<td>31</td>
</tr>
<tr>
<td>4. REQUIREMENTS FOR THE FUTURE HOSPITAL</td>
<td>33</td>
</tr>
<tr>
<td>4.1. Organizational structure</td>
<td>33</td>
</tr>
<tr>
<td>4.2. Competences</td>
<td>34</td>
</tr>
<tr>
<td>4.3. Culture</td>
<td>37</td>
</tr>
<tr>
<td>4.4. Systems</td>
<td>38</td>
</tr>
<tr>
<td>4.5. Requirements in managing tacit knowledge through IT</td>
<td>39</td>
</tr>
<tr>
<td>5. OBSTACLES ON THE WAY</td>
<td>41</td>
</tr>
<tr>
<td>5.1. Organizational structure</td>
<td>41</td>
</tr>
<tr>
<td>5.2. Competences</td>
<td>42</td>
</tr>
<tr>
<td>5.3. Culture</td>
<td>43</td>
</tr>
<tr>
<td>5.4. Systems</td>
<td>44</td>
</tr>
<tr>
<td>5.5. Obstacles in managing tacit knowledge through IT</td>
<td>45</td>
</tr>
<tr>
<td>6. EXPERIENCES IN TWO HOSPITALS</td>
<td>47</td>
</tr>
<tr>
<td>6.1. LUMC</td>
<td>47</td>
</tr>
<tr>
<td>6.2. MCRZ</td>
<td>50</td>
</tr>
<tr>
<td>6.3. Experiences in managing tacit knowledge through IT</td>
<td>54</td>
</tr>
<tr>
<td>7. ANALYSIS</td>
<td>55</td>
</tr>
<tr>
<td>7.1. Analysing case study results</td>
<td>55</td>
</tr>
<tr>
<td>7.2. Analysing the balance in the knowledge environment</td>
<td>57</td>
</tr>
<tr>
<td>7.3. Analysing differences in actor views</td>
<td>58</td>
</tr>
</tbody>
</table>

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7.4. Relations to literature ........................................................................................................................................59
7.5. Analysis of successes and failures ..................................................................................................................61
7.6. Towards a final conclusion ................................................................................................................................62

8. CONCLUSIONS AND RECOMMENDATIONS ....................................................................................................63
   8.1. Conclusion 1: At this moment, do not manage tacit knowledge through IT systems..63
   8.2. Conclusion 2: Manage tacit knowledge differently .........................................................................................65
   8.3. Conclusion 3: Use IT systems differently .......................................................................................................69
   8.4. Conclusion 4: Manage tacit knowledge through IT systems in the future ..........73

9. REFLECTION AND FURTHER RESEARCH ....................................................................................................79
   9.1. Reflection on the research .............................................................................................................................79
   9.2. Further research .............................................................................................................................................81

NOTES ......................................................................................................................................................................83
REFERENCES ............................................................................................................................................................87
APPENDIX I: ANALYSING INTERVIEWS ..............................................................................................................91
APPENDIX II: PROCESS DESIGN ..........................................................................................................................101
APPENDIX III: INTERVIEW QUESTIONS ................................................................................................................107
APPENDIX IV: APPROACH DOCUMENT ............................................................................................................109
Tables and figures

Table 1: Complexity in the hospital unravelled ................................................................. 4
Table 2: General statistics ‘algemene ziekenhuizen’ in The Netherlands over 2004 (NVZ, 2005). 4
Table 3: Four ways of knowledge conversion (Nonaka and Takeuchi, 1995) ........................ 9
Table 4: Differences in knowledge management strategies (adopted from Oldenkamp, 2001) ...10
Table 5: Examples of IT tools in two knowledge management strategies ................................20
Table 6: Classification of IT systems ............................................................................... 19
Table 7: Tensions between tacit knowledge en IT ......................................................... 23
Table 8: Overview of interviews LUMC ........................................................................ 32
Table 9: Overview of interviews MCRZ ......................................................................... 32
Table 10: Respondents LUMC ..................................................................................... 91
Table 11: Respondents MCRZ ...................................................................................... 91
Table 12: Interviews MCRZ managers (Smits, Stevens, Van Aart, Arnoldey and Canrinus) ....93
Table 13: Interviews MCRZ professionals (Van der Stel, Van Donselaar, Bruning, Santman, Teng,
Van der Lely) .............................................................................................................. 95
Table 14: Interviews LUMC managers (Van Lambalgen, Holl, Flikkenschild, De Bes, Meekel) ....97
Table 15: Interviews LUMC professionals (Lagendijk, Elderbroek, De Clercq) ...................... 98
Table 16: Interviews LUMC nurses (Van Raamt, Romsom, Huiberts, Van Loon) ................. 99

Figure 1: Explicit versus tacit knowledge (PricewaterhouseCoopers LLP) ............................ 7
Figure 2: Process of organizational knowledge creation in five phases (Nonaka and Takeuchi,
1995, page 99) ............................................................................................................. 9
Figure 3: Knowledge management cycle and the focus on sharing knowledge (Jashapara, 2004) 9
Figure 4: Four components of knowledge environment model (Van Oirschot, 2003) .......... 11
Figure 5: Personnel categories in the general hospital in The Netherlands (source CBS) ......... 12
Figure 6: The five basic parts of an organization (Mintzberg, 1983) ..................................12
Figure 7: Staff employees (overhead) as a percentage of all employees (source CBS) ............14
Figure 8: The partition of nurses (verpleegkundig en verzorgend) and doctors (behandelend)
(source CBS) ................................................................................................................ 17
Figure 9: Actor dimensions on the knowledge environment ............................................. 18
Figure 10: Capability Maturity Model (Paulk, 1995) ...................................................... 22
Figure 11: Research method ......................................................................................... 28
Figure 12: The three dimensional knowledge environment ............................................. 29
Figure 13: Research structure of the case study .............................................................. 29
Figure 14: Core elements of process design (De Bruijn, Ten Heuvelhof and In ‘t Veld, 2002) ...76

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1. Introduction

"We know more than we can say"
Polanyi (1966)

Managing tacit knowledge with Information Technology (IT) seems impossible. As we know, tacit knowledge exists inside the intangible brain of the human body. Polanyi (1966) states that only parts of this knowledge can be made explicit, by explaining it into human understandable language. Only explicit knowledge can be stored, distributed and accessed in IT systems. Still this challenging impossibility is the starting point for this research.

The health care sector is characterized by this tacit knowledge. Medical processes are executed upon a mix of experiences, feelings and knowledge inside the minds of the clinicians. While the health care sector is under high pressure to increase the quality and efficiency of the delivered care, it is surprising to see that not much research has been done to investigate how the mind of the clinicians really works.1 Literature research (see chapter 2) shows that knowledge management in health care is a relatively untouched area. Improving the quality and efficiency starts with improving the primary processes, the processes in which tacit knowledge play such an important role.

Knowledge management principles offer possibilities to ‘manage’ this tacit knowledge and improve the primary processes. In addition, IT can facilitate knowledge management, by facilitating communication and delivering the information needed to increase the efficiency and quality of the primary processes.

However, the knowledge management principles are not applied in health care, and information technology is not as mature as expected (Berg, 2001).

1.1. Preliminary research question

The potential of knowledge management and IT to create improvements in efficiency and quality in the hospital lead us to the question:

How can hospitals use knowledge management and IT to improve their efficiency and quality? (NB: this is not the research question, see chapter 3)2

To answer this question we need to know:
1. What are the theoretical problems of knowledge management and IT in the hospital?
2. How can hospitals in practice improve using knowledge management and IT?
3. What are the practical obstacles in reaching these improvements?
4. How do hospitals try to reach improvements with IT and knowledge management now?
5. How do the current efforts to reach improvements align with the theoretical problems?

The first sub question is a theoretical question that is answered using literature research in the next chapter (chapter 2). Sub questions 2, 3 and 4 are practical questions that explore using case studies. The approach for these case studies is set down in chapter 3, after I identified several theoretical concepts.
Introduction
2. Theoretical problem exploration

The Dutch health care system disappoints. Too many rules and short falling incentives have created a situation where the patient does not receive the quality of health care as expected in a rich country like The Netherlands. The delivered low levels of safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity indicate the criticalness of the situation. While The Netherlands as well as other countries are being confronted with demographic aging, more mature patients and more chronically ill patients, our health care system operates with overworked professionals that work uncoordinated besides each other. The communication and use of IT-tools is limited. Where there should be one care process, the system is defined by many patient transfers, ineffectiveness and an inefficient use of professionals and finances (Berg, 2001). We are confronted with the results: mistakes, high costs, losing professional motivation and unsatisfied customers.

In November 2003, the minister of health care started the program ‘sneller beter’ to increase transparency, efficiency and quality of the Dutch health care system. Part of this program was to have four different experts in a row advising over ways to improve the health care. The last expert Ad Scheepbouwer (KPN) published his report in June 2006 about innovation in the health care sector. Like the other experts, his conclusions were urgent:

Innovation in health care is necessary to guarantee quality, accessibility and cost effectiveness. There are a large number of barriers in the way of innovation. Only an integrated approach can lower these barriers. Transparency of quality, regulated competition and an optimal use of IT are necessary. This will lead to a better, faster and cost efficient health care.

Conclusion KPN report ‘Zorg voor innovatie’ (June, 2006)

Also in other countries, we see similar problems. In America, the Committee on Quality of Health Care published an urgent report in 2001 about the current way of working: it lacks the upcoming large health care problems in the coming years.

2.1. The hospital as a complex knowledge based organization

The hospital is the school example of health care in practice. It is a very complex organization where doctors and nurses deliver care to patients. These clinicians are supported by a generally large staff and management structure. In The Netherlands, there are 89 ‘algemene ziekenhuizen’ and 8 ‘universitair medisch centra’. In addition to the general hospitals, these academic centres deliver highly specialized care, research and education.

This research covers both the academic centres and the general hospitals, even though there are quite some differences between the two. One case study has been done in the ‘Leids Universitair Medisch Centrum’ and one in the ‘Medisch Centrum Rijnmond-Zuid’. Both organizations are extremely complex in terms of internal and external complexity and in organizational and technical dimensions (see table 1).
Theoretical problem exploration

<table>
<thead>
<tr>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>Large number of technical systems</td>
</tr>
<tr>
<td></td>
<td>Complex interfaces between systems</td>
</tr>
<tr>
<td>Organizational</td>
<td>Large number of employees</td>
</tr>
<tr>
<td></td>
<td>Large number of different functions</td>
</tr>
<tr>
<td></td>
<td>Complex relationships</td>
</tr>
<tr>
<td></td>
<td>Very complex primary process</td>
</tr>
</tbody>
</table>

Table 1: Complexity in the hospital unravelled

In terms of Mintzberg (1983), the hospital can be classified as a professional bureaucracy in a complex but stable environment. Even though in the last twenty years this environment is subject to some changes (competition, increasing government legacy), and therefore in a way less stable, there is no reason to reject this notion. Standardization of skills is the key coordinating mechanism in the hospital. The operating core of the professional bureaucracy plays a central role in the organization and the hospital is characterized by bottom-up decision making. Professionals have power to a large extent and work autonomous from managers. Requirements for the professional bureaucracy, which typify the hospital, are (Boonstra and Van Asch, 1994): (1) the work processes are difficult to learn but well defined, (2) the environment is complex but stable, and (3) the technology is advanced but unregulated.

<table>
<thead>
<tr>
<th>Number of beds</th>
<th>&lt;200</th>
<th>200–300</th>
<th>300–400</th>
<th>400–600</th>
<th>&gt;600</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of organizations</td>
<td>6</td>
<td>19</td>
<td>23</td>
<td>22</td>
<td>19</td>
<td>89</td>
</tr>
<tr>
<td>Average number of beds</td>
<td>904</td>
<td>4810</td>
<td>8047</td>
<td>11024</td>
<td>15379</td>
<td>40164</td>
</tr>
<tr>
<td>Number of beds per organization</td>
<td>151</td>
<td>253</td>
<td>350</td>
<td>501</td>
<td>809</td>
<td>451</td>
</tr>
<tr>
<td>Average number of occupied beds</td>
<td>520</td>
<td>3141</td>
<td>5137</td>
<td>7331</td>
<td>9816</td>
<td>25943</td>
</tr>
<tr>
<td>Number of patients</td>
<td>30910</td>
<td>198951</td>
<td>280202</td>
<td>408338</td>
<td>513715</td>
<td>1432116</td>
</tr>
<tr>
<td>Occupancy (%)</td>
<td>65</td>
<td>73</td>
<td>71</td>
<td>74</td>
<td>71</td>
<td>72</td>
</tr>
<tr>
<td>Average total personnel (fTE’s)</td>
<td>2336</td>
<td>13285</td>
<td>21840</td>
<td>35532</td>
<td>45607</td>
<td>118630</td>
</tr>
<tr>
<td>Number of employees</td>
<td>3716</td>
<td>19522</td>
<td>32258</td>
<td>50445</td>
<td>64953</td>
<td>170894</td>
</tr>
<tr>
<td>Number of patients per bed</td>
<td>34</td>
<td>41</td>
<td>34</td>
<td>37</td>
<td>33</td>
<td>36</td>
</tr>
</tbody>
</table>

Table 2: General statistics ‘algemene ziekenhuizen’ in The Netherlands over 2004 (NVZ, 2005)

The hospitals are under pressure to compete. For competition between hospitals, the quality of the delivered health care is a crucial factor. In addition to quality, reducing costs and increasing the production become important to survive. Improving the quality of the health care, reducing the costs and increasing the production require professional corporate management. The government forces hospitals to deliver key performance indicators for benchmarking. Customers can have insight in this data for their choice between hospitals.

2.1.1. Knowledge in the primary processes

The primary process in hospitals is all the work done to solve the care problem of the patient as far as possible. Berg (1997) typifies this as ‘manage the patient’s clinical pathway’, the core business of professionals and hospitals. This type of work can only to a small extent be caught into detailed protocols or care plans. There are standard components (i.e. procedures, techniques, protocols) from which the work processes are built, but the exact application of all these components and their consistency needs to be determined every time again. Care processes consist of continuously (re)interpreting what is the problem and what needs to be done. They are defined by continuously ad hoc reactions and interactions between professionals to understand the situation and the actions that need to be taken (Berg, 2001).
This specific way of working follows from three special complexities (Berg, 2001):

- The patient is difficult to standardize, because every patient is unique.
- The medical academic fundamentals of health care develop fast and are continuously under discussion. Overview is an illusion in a dynamic world.
- The organizational context in which health care takes place is characterized by many different professionals and organizations that cooperate under time pressure and scarceness.

Working in this complex environment requires professional knowledge. In addition, it requires that knowledge generated in the primary process – like knowledge about the patients – is available. Moreover, that knowledge is used to reflect upon the process: are we doing the right thing? Weggeman’s (1997) way of seeing knowledge as an essential factor of production is very applicable here. Knowledge is everywhere in the primary process of the hospital.

Sadler en Milmer (1991) identified characteristics of knowledge intensive organizations that make clear how important knowledge is for the hospital.

- Professionals are the most important factor of production of the organization.
- Professionals however are not shown on the financial balances.
- Organizations are harmful because professionals can easily leave and take their knowledge with them.
- Managers and professionals trust the creativity and innovation to deal with problems.
- There is a trend to base the success of the organization on different indicators than the financial situation.
- The core activities of these organizations cannot be automated.

All points hold for the hospital, but especially this last point is elaborated in this research. The core activities of the hospital are related to the human body. This body and the health care processes around it are so complex that the activities can never be fully automated. These processes need to be executed by a human: doctors and nurses that give health care. The clinicians work based upon their knowledge of the human body. Managing this type of knowledge of the primary process allows the knowledge in and about the primary process to be used better; and this is a necessary condition for successful improving the quality of health care (Berg, 2001). Therefore, the possibilities of knowledge management in the hospital are further elaborated.

2.2. Knowledge management

"I rather invest in training people who might leave, than not to invest in people who might stay."

CEO - Gartner Group

Knowledge management is not as such an issue in hospitals (among others Berg, 2001). Although traditionally attention is paid to education and information exchange, the concepts that have been evolved when i.e. Drucker (1988, 2001), Nonaka and Takeuchi (1995) and Weggeman (1997, 2000) published about knowledge management, did not land here. The current way of seeing knowledge management in medical literature is to use 'evidence based' knowledge. The focus is limited – compared to the definition that follows in this section – to improve the application of evidence-based knowledge by protocols, education and advanced search engines on the internet (Wyatt, 2001)
Theoretical problem exploration

Unfortunately, cases from knowledge management in the hospital – the example of an organization where knowledge is of crucial importance – have not been found. This section further explains these concepts in a more general form as applicable to any hospital, without going over extended literature about knowledge management. A short overview is given of how knowledge management can be beneficial to the hospital. First, it is important to have a notion of knowledge and the differences in explicit knowledge and tacit knowledge (2.2.1). Second, based upon these differences, knowledge management is introduced (2.2.2). To reduce the breadth of the term knowledge management a demarcation is made based upon the findings in this section.

2.2.1. Knowledge, explicit knowledge and tacit knowledge

When defining knowledge a distinction is often made between data, information and knowledge (Jashapara, 2004). Data is the unrecognized stream we acquire from the outside world. Data becomes information when we organize data to get a meaning out of it. Based on actionable information (Jashapara, 2004) decisions and can be made; and can be considered as knowledge. However, knowledge is much more complex than this notion. Weggeaman (1997) defines knowledge as ‘the personal capacity that enables a person to perform a task’. Numerous knowledge management experts have agreed upon his formula:

\[ \text{Knowledge} = \text{Information} \ast \text{Experience, Skills, Attitudes (K=I*ESA)} \]

Weggeman (1997) sees knowledge as an important factor of production for organizations. Sadler and Milmer (1991) see three reasons why knowledge distinguishes itself from the other factor of productions:

1. Knowledge cannot be wiped out. Different professionals can use the same knowledge often and even at the same time. However, knowledge can get irrelevant when not updated regularly. Knowledge can get lost when it not stored in information components, but tacit knowledge is hard to store.
2. It is hard to protect knowledge. Knowledge as wisdom is difficult to store and employees can leave to other organizations. Even shares of documented knowledge will get lost when authors leave because explicit knowledge can only be applied well in combination with experiences, skills and attitudes.
3. The impact of knowledge on the financial success of an organization is difficult to quantify.

To understand knowledge it is important to distinguish between tacit knowledge and explicit knowledge, a distinction first made by Michael Polanyi in 1966. Tacit knowledge is personal, context specific and hardly be formalized or communicated. Explicit knowledge is codified knowledge that can be exchanged with others through formal and systematic language. Polanyi (1966) stated, “we know more than we can say”, to clarify that all explicit knowledge is rooted in tacit knowledge.

Since academic philosopher, Karl Popper (1972) argued that only explicit knowledge is knowledge, there have been followers that focussed on explicit knowledge systems, neglecting tacit knowledge. They argued that when all knowledge would be made explicit it could be tested and it would not get lost when professionals leave the hospital. Weggeman (1997) typified these approaches as ISO craziness.
Figure 1: Explicit versus tacit knowledge (PricewaterhouseCoopers LLP)7

Figure 1 shows the two types of knowledge. Explicit knowledge is called objective, where tacit knowledge is subjective. Furthermore – following Nonaka and Takeuchi (1995) – explicit knowledge can be associated with rational (mind), sequential (there and then) and digital (theory), where tacit knowledge is experienced (body), simultaneous (here and now) and analogous (practice).

Tacit knowledge

Tacit knowledge is of utmost importance in the primary process in the hospital. Clinicians take decisions based upon their tacit knowledge, sometimes defined as bedside experience or hands on experience. Polanyi (1966) argued that all knowledge is rooted in tacit knowledge. Following his reasoning just parts of all tacit knowledge can be made explicit. Tacit knowledge exists in different forms.

First, there is the physical or practical tacit knowledge. Examples are talking, swimming and bicycling. We can recognize the face of the neighbour without being able to explain it in words as if we can recognize facial expressions but not express them. It is impossible to express in words how we exactly read feelings from faces. We have a total impression of the face.

Second, there is analytical tacit knowledge. This is the experience-based tacit knowledge that allows us to make decisions and do research. The game of playing chess is an example of this form of tacit knowledge. De Schipper (2004) noticed that good chess players distinguish themselves because of quick insights, based on feelings, instead of calculating the best move. Based on intuition an experienced chess player knows instinctively what the best move is in a game. Burns (2003) researched the effects of speed on skilled chess performance and came to same conclusion. There are two mechanisms underlying chess skills: fast mechanisms, such as recognition, and slow mechanisms, such as search through the space of possible moves and responses. Speed chess reduces the possibilities for search and the real chess skill is being uncovered.8

The same way of reasoning holds for medical professionals. While beginners have long checklists for diagnosing, experienced professionals know how to weigh different factors against each other to reach the diagnosis earlier. Exactly this analytical type of tacit knowledge is relevant for medical professionals, and I come back to this later.
Theoretical problem exploration

Practical and analytical can both be learned from experiences instead of codification. It is typically learned in interaction and co-operation between people – in a master-apprentice or collegial relationship (Lundvall, 2001). Simple forms may be accessed through imitation of behaviour, but mostly the learning is strongly facilitated if the master or colleagues co-operates and communicates with the apprentice. One of the professionals that were interviewed for this research made the comparison with a cook in the kitchen. Even if you write down the recipe exactly, the same results will only be reached when there is a chance to look in the kitchen while the food is being prepared.

Some tacit knowledge is so deeply rooted that it becomes hardly manageable. Different systems, management styles, motivations, etc. are necessary to manage each type of knowledge. Often Communities of Practices (CoPs) are created to share knowledge in groups. Literature pays a lot of attention to these forms of knowledge sharing. Daniel Barbiero describes how tacit knowledge can be made explicit under the right circumstances. This principle is used further in this research.

<table>
<thead>
<tr>
<th>Tacit knowledge</th>
<th>Knowledge that enters into the production of behaviours and/or the constitution of mental states but is not ordinarily accessible to consciousness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daniel Barbiero</td>
<td></td>
</tr>
</tbody>
</table>

Other authors describe tacit knowledge as interpreting complex sets of information and seeing patterns that less–experienced people are not able to see. Tacit knowledge is not to be found only at the level of the individual. Lundvall (2001) distinguishes two other levels of tacit knowledge: the organizational and the networked level. An organization with its specific routines, norms of behaviour, codes of information, etc. carries knowledge as well and a substantial part of it is tacit. Industrial networks and inter–firm co–operation may also be seen as repositories of tacit knowledge layered into common procedures and codes, not reflected in formal contracts or any other documents. The informal and tacit character of ‘know–who’ (Lundvall and Johnson, 1994) is crucial for the strength of networks.

Huotari and livonen (2004) mention the importance of trust and tacit mistrust for IT and knowledge management implementations. The lack of organization history and culture in the tacit knowledge of the employees is a critical factor in relation to knowledge and information–intensive activities within organizations. This tacit mistrust is something important in hospitals, and is part of the research conducted in the next chapters.

Knowledge conversions

Nonaka and Takeuchi (1995) elaborate four knowledge conversions, based upon tacit and explicit knowledge. Table 3 lists the four ways to transfer knowledge into different forms of knowledge. Socialisation (1) is the process where experiences are exchanged to create personal knowledge like for instance mental models or technical skills. Externalisation (2) means that personal knowledge is made explicit into codified language. After the process of internalisation (3), explicit knowledge becomes part of tacit knowledge; usually this has to do with learning in practice. Combination (4) synthesizes explicit terms towards a knowledge system by combining different compositions of explicit knowledge.

Because of the focus on tacit knowledge in this research, the processes of socialisation and externalisation are central. Externalisation is a little neglected in literature (Nonaka and Takeuchi, 1995, page. 74). Externalisation is also central in this research, because IT forces knowledge to be made explicit.
Table 3: Four ways of knowledge conversion (Nonaka and Takeuchi, 1995)

Socialisation and externalisation are the first two phases in Nonaka and Takeuchi (1995) model towards organizational knowledge (see figure 2).

![Figure 2: Process of organizational knowledge creation in five phases (Nonaka and Takeuchi, 1995, page 99)](image)

2.2.2. Knowledge management

Many practical methods and tools have been developed to manage knowledge and there is a large amount of literature available about this subject. Jashapara (2004) provides an integrated approach to knowledge management by listing generic activities on the knowledge management cycle shown in figure 3. Knowledge management is commonly seen as a process using these types of continuous cycles.

![Figure 3: Knowledge management cycle and the focus on sharing knowledge (Jashapara, 2004)](image)

Weggeman (1997) and many others distinguish five main processes in knowledge management, that are comparable with Jashapara’s knowledge management cycle (2004).

- Evaluating knowledge and identifying knowledge gaps
- Generating and developing knowledge
Theoretical problem exploration

- Storing knowledge
- Sharing and distributing knowledge
- Applying knowledge

Andriessen (2005) bases his definition on knowledge management on these processes and defines knowledge management as: 'the process of systematic organizing and managing knowledge processes, such as identifying knowledge gaps, acquiring and developing knowledge, storing, distributing and sharing knowledge and applying knowledge'. In theory about knowledge management, many other definitions can be found. Weggeman (1997) gives a shorter definition: 'knowledge management is managing the factor of production knowledge'. Managing is in this definition used to refer to the above-mentioned five main processes.

**Two strategies for knowledge management**

Based upon the differences in tacit and explicit knowledge Hansen, Nohria and Tierney (2000) developed two types of knowledge strategies: codification strategies and personalisation strategies. These two strategies are in many ways comparable with the analytic approach versus the actor approach of De Brujin and De Nerée tot Babberich (2000). In addition, the stock versus the flow approach (Groen and Weggeman, 1996) is based on similar reasoning.

In general the approaches come down to one approach where the tangible explicit knowledge in the organization is analyzed, codified and stored in databases to make it accessible through the organization; and another approach that focuses on bringing people with intangible tacit knowledge together to share their knowledge during communication. Table 4 shortlists these two strategies. In terms of externalisation and socialisation, the codification approach is applicable to externalisation and the personalization approach to socialisation.

<table>
<thead>
<tr>
<th>Knowledge management strategy</th>
<th>Codification (stock)</th>
<th>Personalization (flow)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metaphor</td>
<td>Knowledge logistics</td>
<td>Knowledge market</td>
</tr>
<tr>
<td>Activity</td>
<td>Capture</td>
<td>Connect</td>
</tr>
<tr>
<td>Knowledge exchange</td>
<td>Asynchronous</td>
<td>Synchronous</td>
</tr>
<tr>
<td>Area of attention</td>
<td>Discipline</td>
<td>Personal contact</td>
</tr>
</tbody>
</table>

Table 4: Differences in knowledge management strategies (adopted from Oldenkamp, 2001)

**Defining knowledge management**

Knowledge management is a very broad understanding. In this research knowledge management is focused mainly on knowledge sharing, however to stay compliant with existing literature I keep on referring to knowledge management.

In this section, I focused further on tacit knowledge. Within the different forms of tacit knowledge, the analytical form is the most relevant for this research. Both knowledge conversions that start with tacit knowledge define the continuation of this research: socialisation and externalisation. For these two forms, we need both the codification (stock) and the personalization (flow) approach.

**2.2.3. Knowledge environment**

Keeping these two general strategies in mind the question arises how knowledge management should practically be implemented in organizations. Literature shows that effective knowledge management is usually achieved by using a combination of both approaches and several methods. This is reasonable, professional knowledge exist because of its interaction between explicit
rules and tacit knowledge. Separating these two or focussing on just one approach would be a limited strategy.

Weggeman (1997) shows a successful implementation of knowledge management can be achieved by managing the knowledge processes in such a way that the processes are effective, efficient, flexible and creative and that professionals like to do so. In other words, to practically implement knowledge management in organizations a co–operative setting should be created, in which professionals are stimulated to exchange their knowledge. This follows as well from the literature where for instance conditions for socialization and externalisation (Nonaka and Takeuchi, 1995) are given. The ideas of analytical tacit knowledge sharing in networks from Lundvall (2001) also require such a co–operative setting.

The knowledge environment model (figure 4) from Van Oirschot (2003, page 102) describes how to create such a co–operative setting. The model seems an efficient way to categorize the dilemmas during the interviews. Afterwards I reflect upon the model, the research and the results (see chapter 9).

![Diagram: Four components of knowledge environment model (Van Oirschot, 2003)](image)

**Figure 4: Four components of knowledge environment model (Van Oirschot, 2003)**

Van Oirschot (2003) explains that the knowledge environment is defined by the four components: organization characteristics, systems, competences and culture. The knowledge environment has been introduced by PinkRocade IT Management and combines ideas from knowledge experts like Kessels, Weggeman, Hofstede and Kotter. The knowledge environment model has been used in different international benchmarks, like the European Foundation for Quality Management (EFQM) and the American Productivity and Quality Centre (APQC). Van Oirschot (2003) uses the model to describe that the four components should be balanced in order to create a consistent knowledge environment.

The outside world is an essential influence on the knowledge environment. An organization needs to position itself in relation to changing circumstances. Van Oirschot (2003) uses the relation with the outside world (outside–in perspective) to define the link with Future Management. An organization can use the knowledge environment to stay in his words ‘future proof’.

This model is further used in this research. Because an explorative research is being conducted using interviews in which perceptions are asked, there is no further need to define theoretically the different aspects of the model. However, one important demarcation is made. The system component traditionally stands for all kind of systems used in organizations (HRM systems, financing systems, training systems, salary systems, etc.) the systems component in this research is explained as being IT systems. Before elaborating more on the model and the ways it
is used, first I explore the different actors in the hospital and their attitude towards knowledge management. Because the principles of knowledge management should be applicable to them, it is important to get to know them better.

2.3. Hospital actors and knowledge management

On average Dutch hospitals have over 1400 full time equivalents (fte) per hospital, with many part-time jobs this means there are even more employees. The last six years the overhead has been increased with over 30% (see figure 5)

![Figure 5: Personnel categories in the general hospital in The Netherlands (source CBS)](image)

These can best be classified according to Mintzberg (1983) his five basic parts of an organization (see figure 6).

![Figure 6: The five basic parts of an organization (Mintzberg, 1983)](image)

The strategic apex of the hospital is occupied by the board of directors, the president and executive committee. They are supported by the techno structure, consisting of strategic planning, controller, and personnel training, scheduling and work-study. The supporting staff facilitates the organization with IT-support, legal counsel, public relations, pricing, payroll, reception and cafeteria. Middle management in the hospital is generally small. Division managers and team managers can be found here. Middle managers in hospitals typically have a large span of control. The primary process in the hospital is run by the operating core, consisting of doctors and nurses.
Following Mintzberg, each part of the organization has special characteristics; this is elaborated as far as they influence the possibilities for knowledge management.

2.3.1. Strategic apex

As said, the hospital can be classified as a professional bureaucracy, which is characterized by bottom-up decision making. This implies that the operating core, with its autonomous working professionals, is to a small extent controllable by the strategic top. Management is mostly functioning as conflict resolution. Another role for the strategic apex is to maintain external liaisons. (Mintzberg, 1983)

What does the lack of possibilities for command and control mean for management? According to De Bruijn and Ten Heuvelhof (1999), a process management approach is required for managers that want to control somehow. De Bruijn and De Nerée tot Babbereich (2000) describe the impact and the possibilities for knowledge management through such a process orientation of management.

In the continuously more demanding environment of the hospital (regulation, competition, etc.) the strategic apex plays important role. Knowledge management solution can largely be initiated by them. Nonaka and Takeuchi (1995, page 87) defined five circumstances that stimulate the exchange of knowledge in organizations:

- Intention: the organization striving towards its objectives
- Autonomous and self-sufficient
- Fluctuation and creative chaos
- Redundancy
- Necessary modesty

Managers become aware of the fact that creative and innovative professionals are essential for the flexibility and performance of an organization. Drucker (1988) sees a clear transition from a command and control organization, via a departmental organization, to an organization with knowledge professionals. Managing these professionals is a challenge to professional organizations. The management view on knowledge management is characterized by achieving efficiency in the processes to reduce costs. Knowledge management is seen as a tool to enhance organizational performance and reach the mission of the organization. Knowledge processes should therefore directly be linked to organizational goals.

Tension in this view occurs between acknowledging autonomy to professionals and controlling more tight and be able to steer the organizations from the top. This dilemma occupies management because leaving autonomy to professions leave space for – for instance – creativity, while more control increases efficiency.

2.3.2. Techno structure

The techno structure in a professional bureaucracy is typically insignificant (Mintzberg, 1983), as is the case in hospitals. Advanced controlling, planning and training is to a limited extent needed for the autonomous working professionals. Administrative planning of patient is executed, but these planners have a relatively small influence on decision-making. In the research they are therefore neglected, and – for as far as considered important – be grouped under the strategic apex where it are management supportive functions and under the supporting staff where the support the organization.
2.3.3. Supporting staff

The supporting staff instead is typically large in hospitals; up to 15% of the total staff in general hospital and even up to 23% in academic hospitals (figure 7). The way the supporting staff is organized differs from the way the hospital itself is organized. To support the professionals the staff is regulated like a machine bureaucracy. The elaborated department is a very organized, characterized by top down decision-making and their key coordinating mechanism is standardization of work. These differences in regulation system and authority influence the distance towards the organization. A large distance between the supporting staff and the primary process is often perceived.\(^4\)

Figure 7: Staff employees (overhead) as a percentage of all employees (source CBS)\(^5\)

Supporting staff in the hospital is not regarded as leading, though they determine largely the possibilities for the professionals. Knowledge management solutions should be supported by them, especially if they need technology. Knowledge management can play a crucial role to the supporting staff department itself as well, however it needs a different approach. Since the primary coordination mechanism is standardization of work processes, knowledge management should have a strong standardized character. The hospital organization tries to achieve standardization of skills with individual autonomy; this requires a knowledge management system to be flexible on the individual level.

The perspective of these analysts is characterized by codification. They see knowledge management as a way to structure work processes and an ability to get insights in explicit documents. Archiving knowledge is considered important. The codification strategy is the most dominant strategy. In organizations, it is often seen that a manager from this techno structure gets to implement knowledge management methods and tools. No wonder that in current organizations more emphasis on explicit than on tacit knowledge can be found.\(^6\) This leads to the main tension for knowledge management from the perspective of the supporting staff: codification or personalization.

Even though supporting staff is considered very important in giving the space for knowledge management solutions, they have a small influence on the solutions chosen. Because the supporting staff department needs a different approach (codification) for knowledge management systems as well, the supporting staff division is not considered as one of the main actors in this research.

2.3.4. Middle line

The strategic apex is joined to the operating core by the chain of middle line managers with formal authority (Mintzberg, 1983). This chain runs in the hospital from the division managers to the team leaders. These team leaders are the supervisors of the operating core. The organization needs the chain of middle–line managers because the span of control of the strategic apex cannot cover the complete operating core. Middle–line managers in hospitals usually have a
large span of control. Therefore, a typical hospital has a small middle line. This acknowledges the line of reasoning that professionals have strong autonomies and that professionals are not waiting to be controlled.

Even though middle–line management plays an important role in communication between professionals and strategic apex, the middle line has a relatively small influence on the primary process and the possibilities for knowledge management. Therefore, they are – similar to the techno structure and supporting staff – neglected and grouped under the strategic apex. In the remainder of this research, this group of strategic apex, techno–structure, supportive staff and middle–line management is indicated with the term management.

This leaves us with two groups: management and operating core. However, the operating core of the hospital is depicted by two different groups: doctors and nurses. Knowledge management is highly relevant for both doctors and nurses, but each group has different characteristics, so they require a separate description.

2.3.5. Operating core: Doctors

The doctor makes the medical decisions in the hospital. Doctors are specialised to give the right medical treatment. They are often highly specialized in certain areas of the body. Although some are generalists, like the internist that have the whole body as their scope of work. Doctors follow an intensive education, where they learn the basics of each speciality, and they specialize at the end of their study.

The different academic areas in health care are continuously being developed. The doctors are forced to keep on following these developments after finishing their study. Being up–to–date is a requirement for their work. To stay in touch with the developments the doctors use internet, magazines and maintain communities. Knowledge management plays an important role here and the doctors themselves are responsible for it.

In the academic hospitals are doctors are part of the organization. However, in most general hospitals, doctors are not on the payroll of the hospital, but they form their own organizations (maatschappen) that have a contract with the hospital. This, together with the notion that professionals work autonomously, makes it difficult to manage doctors with command and control. Management in hospitals lacks the possibility to steer in the traditional way. De Bruijn and Ten Heuvelhof (1999) give methods for managing these professionals in a process approach. Some hospitals have realized that working with external professionals is difficult; they have recruited the professionals themselves.

The complexity of the primary process of doctors allows for knowledge management in and about the primary process (Berg, 2001). Knowledge management can improve the efficiency and quality of the medical treatments. Research effort put into medical decision making shows that medical decisions could be supported to some extent by medical decisions trees. These trees are based on statistics. Doctor’s medical decisions can to a far extent be supported by IT.

However, not all decisions can be supported by IT. Some decisions need to be made on so many factors that they become too complex for standardized models. The professional needs to call upon his tacit knowledge to make decisions. In section 2.5, I elaborate on this statement that not all decision can be automated.
Theoretical problem exploration

Furthermore, in this research this group is referred to as professionals. Even though nurses and to a certain extent managers are of course professionals in their work as well, the doctors are the closest to the characteristics of the literature professionals in the work of Mintzberg (1983) and Weggeman (1997). According to Mintzberg, Weggeman and other authors, professionals give complications for management.

In literature the term knowledge workers is often used to refer to professionals. Kerr, Von Glinow and Schrisheim (1977) identified the following characteristics of professionals: knowledge, autonomy, motivation, identification, moral norms and professional standards. The professionals often work individually. When working together the relationship is ‘loose–fixed’ around a certain subject or task. Weggeman (1997) elaborates on two types of professionals: the r–prof and the i–prof.

- The r–profs work with routines and standardizations. They are the ones Mintzberg (1983) mentions when he argues that for a professional bureaucracy "the organization turns to the one coordinating mechanism that allows for standardization and decentralization at the same time, namely the standardization of skills". Referring to the knowledge formula of Weggeman (1997) they work with the knowledge components experiences and skills. According to Weggeman, the traditional view on ‘explicit’ knowledge management is most applicable to these professionals.

- I–profs are characterized by improvisation. They work mainly with the knowledge components information and attitude. They use creativity to produce innovation and new knowledge. ‘Tacit’ knowledge management can support these professionals.

It is difficult to attach one of these types to the professionals in hospitals. Sometimes they act as typical r–profs, when it comes to yet another patient with the same problem. However, often professionals are confronted with unique problems. Given the fact that each patient is unique as well, professionals have to work with creativity and can act as i–profs.

Literature (among others Weggeman, 1997) reveals that the main dilemma in the way of knowledge sharing for professionals regards their autonomy. Sharing knowledge breaks the independent unique position of the professionals, however receiving knowledge allows for individual learning. It is not sure if this dilemma holds for professionals in hospitals as well. Professionals are highly specialized and sharing knowledge would not immediately lead to others specializing in the same area. Moreover, the professionals are together helping the patient and knowledge is needed to provide the best medication.

Professionals share in dept knowledge about their specialization with colleagues in other hospitals. Often there exist networks between these professionals. Inside the hospital, they often work in close teams. Some professionals are so highly specialized that they are not found in every hospital, these professionals maintain connections around the world.

2.3.6. Operating core: Nurses

A nurse is a health care professional who is engaged in the practice of nursing. Nurses are men and (mostly) women who are responsible (along with other health care professionals) for the treatment, safety and recovery of acutely or chronically ill or injured people, health maintenance of the healthy, and treatment of life-threatening emergencies in a wide range of health care settings. Nurses may also be involved in medical and nursing research and perform a wide range of non-clinical functions necessary to the delivery of health care.
Figure 8: The partition of nurses (verpleegkundig en verzorgend) and doctors (behandelend) (source CBS)\(^1\)

An unfair distinction is made between professionals and nurses in this research. Nurses are definitely professional as well. Nurses support the doctors and give direct patient care. Most of the employees in the hospital are nurses. Nurses usually work in shifts, because it is a 24-hour job to take care of patients. Where doctors make the medical decisions, nurses execute these decisions and make sure the patients’ reaction is as expected. Professionalism is definitely needed here too.

The decision to make a distinction between professionals and nurses in this research is based upon literature. Authors like Weggeaman (2000), Nonaka and Takeuchi (1999), and Sadler and Miller (1991) refer to a professional because of characteristics mentioned above. Nurses differ from these characteristics. They work more routinely and less autonomously. The nurse research area is conservative and being less developed than medical research areas. Nurses are to a small extent motivated to follow developments after they finish their education.

Nurses work more hierarchically and in teams with shifts. Their work requires knowledge management. The two types of knowledge management strategies can benefit to their work: (1) codification and (2) personalization. With codification, they can make protocols explicit. By working standardized, the quality improves. Personalization can benefit to the tacit knowledge of the nurses. Nurses operate based upon tacit knowledge and their experiences. Their knowledge is usually shared when working together in practice. Sometimes trainings are organized, however in most cases there is not much education once they finished their study.

2.3.7. Towards one model

In this section, I have chosen three actors that have different characteristics and perspectives on knowledge management. To implement knowledge management different approaches are needed for each group. The knowledge environment model (figure 4) of Van Oirschot (2003) is used again. However, the model is slightly adapted.

The relation with the outside world is in this research considered less important. The research focuses on the four components of the knowledge environment: organizational structure, competences, culture and systems. The latter has been demarcated to IT systems in the previous section. Important is how the components relate together. To structure the three different actor perspectives in this research, Van Oirschot’s model is extended with an extra dimension (see figure 9). For each actor (management, professionals and nurses) the knowledge environment and its components are researched.

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Theoretical problem exploration

Figure 9: Actor dimensions on the knowledge environment

So far, we explored the complexity of the hospital, the possibilities for knowledge management and the different actor perspectives. The theoretical concepts provided us with a useful knowledge environment model; however, the role of IT in this has not yet been uncovered. The coming section reveals the possibilities for IT to support knowledge management and the current use of IT in the hospital.

2.4. The role of IT in managing the intangible

“If the smart manager knows one thing, it is that knowledge management is not just about technology. But, if the smart manager knows two things, the second is that in today’s age of technology–driven communication and information production, the role technology can play to facilitate knowledge management should be examined.”

Koulopoulos and Frappalo (1999)

Drucker wrote in 1988 about ‘the coming of the new organization’. Information Technology (IT) and the increasing importance of knowledge would have a revolutionary effect on organizations. The use of IT could facilitate self–steering independent teams of knowledge workers and flatten the organization. Middle management could shrink and employees could work independent instead of traditional top–down management command and control (Drucker, 1988). Attracted by the successes in many businesses over the last years, this ‘hype’ has now reached the health care sector. Can IT and the focus on knowledge be the solution for the problems in the hospitals?

Paradoxical Drucker used in 1988 the hospital in his work as an example of the ideal, flat, knowledge intensive self–steering organization. The idea that the hospital with its internal organization stumbles, inefficiencies and steering dilemmas has been the delighted example for ten–year management hype perhaps indicates the depth of these hypes (Berg, 2001).

However, even if IT and knowledge management are seen as hypes over the past years, there lies a potential in them to support the hospitals in their challenges. A quick scan22 conducted in the beginning of this research revealed that knowledge management is not yet on the agenda of managers in health care organizations, but the perception that knowledge management can benefit to care processes is generally shared. To explore the possibilities of IT to facilitate knowledge management, the different forms of IT are classified. This classification allows ap-
pointing different functions of IT that define the role IT can play in managing the intangible
knowledge.

2.4.1. IT and knowledge management

IT systems provide many solutions to support knowledge management. The main possibilities of
IT systems can be explained through the codification and the personalization strategy. In codifi-
cation strategies, IT can be used to store, distribute and access explicit knowledge. IT forces
knowledge to be made explicit. Different forms to store, distribute and access explicit know-
ledge are very common in today's world. Websites, databases and repositories are IT tools to
support the storage of knowledge. E-mail and web servers are common forms through which
information is distributed. Search engines make this data stack searchable and browsers make
data accessible.

IT has an impact on the codification of knowledge. On the one hand, IT makes it less costly to
codify knowledge and in some areas much more attractive to do so. The internet where the mar-
et for information explodes gives new incentives to codification (Lundvall, 2001). On the other
hand, IT has a major impact on speeding up change and increasing complexity in the knowledge
base. This is why tacit knowledge becomes even more important than before and this is espe-
cially true for tacit knowledge that is helpful in locating, selecting and using information. There-
fore tacit knowledge and interactive learning do not become less, but more important with the
impact of IT (Lundvall, 2001).

In personalization strategies, IT can be used to connect people with each other and allow sharing
of implicit tacit knowledge by supporting communication. Examples of IT systems supporting
these strategies can be found in table 5.

<table>
<thead>
<tr>
<th>Codification strategy</th>
<th>Personalization strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Databases, repositories</td>
<td>E-mail, Instant Messaging, Voice over IP</td>
</tr>
<tr>
<td>Search engines</td>
<td>Groupware, networking tools</td>
</tr>
<tr>
<td>Browsers</td>
<td>Learning tools</td>
</tr>
</tbody>
</table>

Table 5: Examples of IT tools in two knowledge management strategies

Both the IT systems to store knowledge and those that connect people should work together to
create a co-operative setting. In this research, it is assumed that the role IT plays is crucial for
the success of knowledge management. Therefore, the alignment of the IT systems with the
organizational structure, culture and style of management is important. Making these aspects
work together, defines the success of professional knowledge management in an organization
(Van Oirschot, 2003; Rao, 2005; Weggeman, 1997; Huotari and livonen, 2004).

Experiences in other sectors

Even if experiences with knowledge management and IT systems in the health care sector are
unavailable, it is worth looking at experiences in other sectors. Authors like Montano (2005) and
Madanmohan (2005) gathered experiences in using IT systems to manage knowledge. Both ac-
tors revealed successes and failures in IT implementations and the factors behind it. It turns out
that good working and user–friendly applications are needed for success, but that the way the
tool is used inside the organization defines the real success or failure.

In general, these authors conclude that knowledge management can add great value to organi-
zations, when it is implemented with awareness of the organizational needs. Many successful
cases in different types of organizations reveal the different benefits of knowledge management
for organizations. IT, once implemented rightly, can support both the codification and the personalization strategy.

### 2.4.2. Classification of IT systems

IT systems are available in all forms. For the purpose of knowledge management a classification is made consisting of five types of systems that can be used for different forms of knowledge exchange (see table 6). The first category (the repositories) is used to store, distribute and access explicit knowledge. The next category has to do with interpreting this explicit knowledge and delivering it to the human mind in a form that facilitates learning. The third category of social software consists of artificial intelligence software that is used to interpret explicit knowledge by computers to deliver intelligent answers to for instance questions. The networking tools are used to map social skills from a group of people. By making competences explicit in for instance a face book one can find each other when confronted with specific problems. The last category facilitates the exchange of knowledge by supporting communication.

<table>
<thead>
<tr>
<th>Repositories</th>
<th>Learning tools</th>
<th>Social software</th>
<th>Networking tools</th>
<th>Communication tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Databases</td>
<td>e-Tests</td>
<td>Artificial intelli-</td>
<td>Personal networks</td>
<td>Groupware</td>
</tr>
<tr>
<td>E-books</td>
<td>e-HRM</td>
<td>gence</td>
<td>Knowledge cards</td>
<td>IM, Video conferencing, VoIP</td>
</tr>
<tr>
<td>Internet</td>
<td>Mind mapping</td>
<td></td>
<td>Face book</td>
<td>E-mail</td>
</tr>
</tbody>
</table>

Explicit knowledge (stock) ➔ Tacit knowledge (flow)

**Table 6: Classification of IT systems**

### 2.4.3. Current IT systems in health care

In health care, we see mainly applications of the first type (repositories). These are the database systems for protocols, patient or disease information. The middle categories of learning tools, social software or networking tools are hardly found. Basic communication tools like e-mail and (mobile) phone use can be found, but scarcely any more advanced application for communication are available. This is in line with Hansen, Nohria and Tierney (1999) who argue that mostly an 80% codification and 20% personalization emphasis is found in organizations (their well-known 80–20 split).

A quick scan exploration among IT developments in hospitals is conducted using the four views from Tapscott and Caston (1992): (1) Business, (2) information, (3) application, (4) infrastructure. They wrote that these views give a complete picture of IT, because IT is traditionally just approached from infrastructure. Tapscott and Caston (1992) argue that the different perspectives are intertwined and cannot be separated from each other. Each of the views is dependent on the other views.

The differences inside and between hospitals can be large, but the following are the main developments that can be found everywhere.

**Business perspective**

From a business perspective the main IT developments for the primary processes are:
- Protocols are stored, distributed and accessed through IT systems, usually the intranet.
- Primary processes are being automated where possible.
- Administration is automated where possible.
- Tele-consulting is explored as a way to use IT to consult where physical presence cannot be realized.
Information perspective

Information in the hospital is largely linked to patients and this is shown in the main developments from an information perspective:

- The **Electronic Patient Record** (EPR) is used to store patient information. The problem around the electronic patient records is that currently most processes have their own EPR, but that they are not connected. This requires the same information to be entered into the different systems and prevents intelligent linkages between information about the same patient in different systems.
- The **BSN** (Burger Service Number) is a unique number for every patient that is introduced by government. Identifying every patient with a unique number is needed to prevent information loss.
- Who has access to which information, and how identification takes place, is arranged in the **UZI program** (Unieke Zorgverleners Identificatie). Each clinician gets an identification card and each computer is equipped with a card reader to allow safe and quick authentication.
- Digital declarations at health care insurances.

Application perspective

Many specific applications can be found in the hospital for specific processes, for instance PACS (Picture Archiving and Communication System) to archive and distribute x-ray photos through the hospital. There are also some general applications like office applications for administration purposes. The central system is usually the ZIS (Ziekenhuis Informatie Systeem), in which all basic information (i.e. about the employees and the patients) is saved. Hospitals usually have an intranet on which organizational information (i.e. internal vacancies, dinners) can be found. Often there is a protocol system linked to this intranet where protocols are stored. Moreover, e-mail is used for the communication.

Infrastructure perspective

From an infrastructure perspective, most hospitals have wired networks and personal computers available for most medical professionals, supporting staff and management. For nurses there are less computers available, they usually have to share a few central computers. Although there are large differences between the hospitals, the infrastructure and applications are generally old fashioned. For the data intensive PACS application, hospitals need a revolution in their network. Mobile networks are only in place for telephones. Traditionally hospitals have all IT in house. Out-sourcing is not an issue yet.

Security is an important issue in the hospital. Private or sensitive patient information cannot be send over the Internet. Large telecom operators (like KPN) provide secure networks between organizations to allow secure data transfers. However, only at some places these networks are used.

Maturity of IT systems

IT departments can measure their maturity with the Capability Maturity Model (Paulk, 1995). This model (figure 10) reveals five steps for knowledge intensive organizations to increase its level of professionalism. IT departments in hospitals indicated they are often still taking the second step (the repeatable level). The IT department is therefore closer to the first step (ad-hoc operation organization) than the fifth step (self-learning organization). Using the model organizations can set goals for each step and perform assessments.
Theoretical problem exploration

![Capability Maturity Model (Paulk, 1995)](image)

**Figure 10: Capability Maturity Model (Paulk, 1995)**

The quick scan revealed that most systems are database systems that support the codification approach of knowledge management. Only a small amount of systems supports the personalization strategy that is central in this research. This is an important barrier to tacit knowledge management.

IT is everywhere embedded in the hospital. However, it lacks an integrated architecture. It has many different components. The minister of health care started an investigation of the status of IT in the health care sector. Different experts from other sectors evaluate the way IT is used and give suggestions for improvements. The general conclusion about IT in the health care sector is that IT is some 10 years behind IT in for instance the corporate sector.

### 2.4.4. New developments in IT

Looking into the future, new developments on all perspectives are predicted (Berg, 2001). The fact that hospitals are more than ten years behind IT developments in the corporate sector allows taking these developments into account (Montano, 2005). IT provides possibilities for communication. Both asynchronous (like e-mail, web-logging and instant messaging) and synchronous (internet telephony, videoconferencing) communication allows more efficient and effective communication (Davenport, 1993). Efficient, because less time is needed to contact each other when for instance the availability of the other persons can be seen on forehand. Effective, because conversations can be saved and the same questions do not need to be asked repeatedly. The developments of IT provide more and more possibilities to support both communication and personalization strategies in knowledge management (see section 2.2 or Jashapara, 2004).

In addition, for the health care processes IT developments provide advantages:

- **One integrated process** In hospitals, there is a trend towards organizing the clinical processes in such a way that the patient flows as an entity through this model between the health care processes within and between different organizations. This way of organizing among clinical pathways can to a large extent be supported by IT systems (Berg, 2001)

- **EPR** Transfers of patient information between health care processes is fully automated, all information is available.

- **Management information** Statistics and management information are available about the whole population.

- **Support of decision-making** Decision support systems can based upon these statistics and decision trees inform the professionals in their medical decision making.
Monitoring and alarming systems when patients’ symptoms do not match the clinical pathway followed.

2.4.5. Tension between tacit knowledge and IT

Literature in this section showed the importance of tacit knowledge in the health care processes. I revealed some trends that increase the need for tacit knowledge. Main trends were:

- Organizational changes in hospitals that require tacit knowledge and organizational memory.
- The trend towards organizing processes among clinical pathways requires more cooperation and coordination between professionals and therefore insights in tacit knowledge. In addition, this trend requires tacit knowledge to be exchanged among professionals.
- Rapid IT developments make it possible to codify and distribute knowledge, however, interpreting and working with this knowledge requires tacit knowledge.
- The informal and tacit character of ‘know-whos’ is crucial for the strength of networks.

Tacit knowledge and IT therefore require each other. However, this section revealed also the tension between tacit knowledge and IT. I summarized the main frictions in table 7.

<table>
<thead>
<tr>
<th>Tacit Knowledge</th>
<th>IT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analogous (practice) and experienced (body)</td>
<td>Digital (theory) and rational (mind)</td>
</tr>
<tr>
<td>Implicit knowledge, difficult to explicate, hard to discuss (subjective)</td>
<td>Requires somehow explication, explicit knowledge is discusstable (objective)</td>
</tr>
<tr>
<td>Intangible, difficult to store and distribute</td>
<td>Able to store and distribute</td>
</tr>
<tr>
<td>Only available under certain conditions</td>
<td>Always available</td>
</tr>
<tr>
<td>Created by experience</td>
<td>Created by explication</td>
</tr>
<tr>
<td>Person dependent</td>
<td>Person independent</td>
</tr>
</tbody>
</table>

Table 7: Tensions between tacit knowledge en IT

Following these findings, it is difficult to manage tacit knowledge through IT systems. The possibilities to play a role in tacit knowledge management for IT are limited to facilitate the communication. This can be done by giving insights in who knows what (who to contact) and by supporting the communication itself (for instance video conferencing). Through a rich way of communication, tacit knowledge can be distributed. It is however difficult to get a grip on which tacit knowledge exist where (reveal tacit knowledge) or to manage streams of tacit knowledge.

2.5. Where is the limit?

While IT is marching his way into the health care processes, the questions arises how far the automation will go. Can IT fully take over the primary processes in the hospital? Berg (2001) gives the answer to this question, and argues that there is a limit. Although, where exactly this limit would be, is not revealed.

This chapter covered the concepts of tacit knowledge and its characteristics. Only explicit knowledge can be automated and professionals need to stay in place because they can call upon their unique tacit knowledge.

The human body is complex, and consisting of a large number of dependent factors, with very complex relationships. All these complex factors and their relationships can never be completely automated. Only a limited number of factors and relationships can be considered in technical models of the human body. Making medical decisions can therefore never be trusted to IT. Only
Theoretical problem exploration

human beings can make decisions based on a large number of complex factors. When IT cannot provide answers, humans can invoke their tacit knowledge.

One other important aspect needs to be mentioned here. Even if IT would be able to make medical decisions based upon information about the patient, it is good to have a person make the final decision. The reason for this is that a human can consider the ethical aspects of the decision. Do we really want to do this to this patient? If IT systems give this complex operation as the only solution to help this elderly person, a human approach would make sense to investigate if this is the technical best solution is also the most wanted solution. Not much research has been done on the ethical aspects of automated decision-making.32

It is good to realize there is a limit to the application of IT. However, this limit will not be reached yet. It is not clarified in literature where this limit exactly would be. One of the questions asked in the interview for this research is where this limit is.

2.6. Problem demarcation and statement

This chapter explored the problem of tacit knowledge management in hospitals. The chapters started with the urgency to increase the quality of health care in the complex hospital. It clarified how the concepts of knowledge and knowledge management can propose solutions for the problem. Knowledge management however is not yet applied in hospitals. They struggle with obstacles and different perspectives from three main actors: managers, professionals and nurses.

IT is marching its way into the hospital proposing both new solutions and problems. Evaluation of different IT projects showed that they often fail to add real improvements to the primary processes. The primary processes are so complex that hospitals struggle with the question how IT promises can be reached.

During the exploration, different demarcations have already been made.

- Knowledge management covers five (Jashapara, 2004) knowledge processes, but main emphasis is on knowledge distributing and sharing.
- Knowledge exists in different forms: medical information is patient dependent, and tacit knowledge and explicit knowledge are patient independent. Tacit knowledge and explicit knowledge are intertwined. Although in this research the focus is on tacit knowledge, as it plays an important role in the medical processes, it would be unjustified to ignore explicit knowledge. Two approaches need to go hand in hand: the personalization approach and the codification approach. Most current IT systems force knowledge to be made explicit, they play a very important role in delivering the right patient information and they can be used to deliver explicit knowledge. Systems that allow the sharing of tacit knowledge (networking and communication systems) are not available in a large number or not used as such.
- The importance of knowledge conversions for knowledge management has indicated. In this research, the focus on the knowledge conversion processes of socialisation and externalisation.
- The different approaches need to be implemented in a balanced way, leading to the optimal knowledge environment.
- It is assumed that the role IT plays is crucial for the success of knowledge management.
- To analyse this knowledge environment and the role of IT further the model over Van Oirschot (2003) is used that consists of four aspects: organizational structure, competences,
culture and systems. To simplify the model, the outside world is a little neglected and for the system component, only IT systems are considered.

- In addition, the model is extended with the three actor perspectives that make a successful implementation of knowledge management even more difficult, because each actor focuses on its own dilemmas. Managers see knowledge management as a tool to enhance organizational performance by reducing costs but they focus a dilemma between autonomy and freedom for the professionals or strong command and control. Professionals experience knowledge management as a possibility for individual learning; however, they are keen on their autonomous position. Nurses work more routinely.

The theoretical exploration of the problem in this chapter has lead to the following problem statement:

Hospitals are faced with an urgency to increase the quality of health care. IT and knowledge management offer potential solutions, however, for hospitals it is unclear how to use the potential of IT and knowledge management, given the complexity of the hospital and the fact that intangible tacit knowledge is so important.

The next chapter gives research questions to test the assumptions behind this statement in practice and find solutions to realize the potentials benefits of IT and knowledge management for hospitals. In the case study research, the concepts of technical and organizational complexity, the knowledge environment and the different actors in the hospitals is used.
Theoretical problem exploration
3. Research approach

In chapter 1, I introduced the question: “how can hospitals use knowledge management and IT to improve their efficiency and quality?” The previous chapter has identified the theoretical concepts behind the problem of using knowledge management and IT in the complex hospital. The chapter revealed theoretical concepts that are used in case studies. In this chapter, the research question from the first chapter is sharpened into the definite research questions, using the findings of the previous theoretical chapter (section 3.1). A research method is proposed in section 3.2 to generate answers to these questions. In 3.3, a research demarcation is made and in 3.4 research objectives are formulated.

3.1. Sharpened research question

Based upon the findings in the literature we can say that the possibilities for knowledge management are barely used in hospitals. Faced with the urgency to increase their efficiency and quality, hospitals see the potential of knowledge management, but it is as such nowhere implemented yet. IT systems march their way into the hospital and provide possibilities for codification and personalization strategies of knowledge management. Since especially tacit knowledge plays an important role in the primary processes of the hospital, it is worth considering how tacit knowledge can be managed through IT systems.

This leads us to the following sharpened main research question:

How can hospitals manage tacit knowledge through IT systems? (chapter 8)

Behind this question, there is a challenging impossibility to manage tacit knowledge through IT systems. Table 7 in the previous chapter revealed the different tensions between tacit knowledge and IT. Chapter 2 has however provided us with some concepts of tacit knowledge management and IT that are further explored in practice.

Five sub questions are asked in order to be able to answer the main research question. The first question has been answered using literature research in the previous chapter.

1. What are the theoretical problems and concepts behind managing tacit knowledge through IT-systems? (chapter 2)

Based on the findings of chapter 2, the remaining research questions are sharpened. Important findings were the importance of tacit knowledge and the challenge to use IT for the management of this type of knowledge. In addition, three actor perspectives have been identified, because management, professionals and nurses form different groups with their own characteristics. The following questions are answered using case studies to gather answers from practice.

2. What are the requirements for managing tacit knowledge through IT systems from the three actor perspectives? (chapter 4)
3. What are the obstacles for managing tacit knowledge through IT systems from the three actor perspectives? (chapter 5)
4. What are the experiences in dealing with these obstacles? (chapter 6)
Research approach

The three case study question result in requirements, obstacles and experiences in practice. A last sub question is asked to analyse these finding and link them with the first question.

5. To what extent can the requirements and obstacles explain successes and failures in experiences and how can this be linked to the theoretical problems? (chapter 7)

The findings of the literature study and the case studies are linked in the analysis (chapter 7). Based upon the analysis, chapter 8 gives conclusions and recommendations by answering the main question of this research. Finally, chapter 9 gives a reflection upon the research. This chapter elaborates further on the approach of the case studies.

Figure 11: Research method

3.2. Research method

Figure 11 gives an overview of the research method. The literature study in chapter 2 provided theoretical concepts that are used in the case studies. The sub question 2, 3, and 4 are answered using the result from case studies. Case studies have been chosen, because they are the best method for explorative research (Yin, 2003). Experiences in practice are gathered using interviews.

While chapter 2 provided only the results from the literature study, chapters 4, 5 and 6 only provide the results of the case study. During these chapters, no references to literature are made, to make clear that the results have only been achieved in the case studies. All results in these three chapters follow from the interviews. In chapter 7, the results from the literature study and the case studies are linked and an analysis will be made of similarities and dissimilarities. Before that, I elaborate on the selection of cases and interviews and clarify the structure used.

Following the findings in the previous chapter, the knowledge environment model Van Oirschot (2003) consists of four useful aspects to structure the research (see chapter 2). Organizational structure, competences, culture and systems are important aspects of the knowledge environment. Together with the three chosen actor perspectives, a three dimensional knowledge environment has been created (see figure 12). Requirements, obstacles and experiences (sub
questions 2, 3, and 4) are structured using this three dimensional knowledge environment model.

Figure 12: The three dimensional knowledge environment

Figure 13 shows how this case study research is structured in four steps (requirements, obstacles, and experiences leading to analysis) with the three-dimensional knowledge environment at the background.

Figure 13: Research structure of the case study

3.3. Research objectives

Solving problems in health care is highly socially relevant and a hot topic in today’s newspapers. Lots of research has already been done to improve the health care system. However, a few have lead to any real success. Most interventions have lead to more rules and bureaucracy. Real improvements should start from the primary process, there where the possibilities for progress are the largest. Because the primary processes in health care are knowledge intensive and performing tasks requires tacit knowledge, a research on tacit knowledge can potentially benefit to increase the efficiency and quality of health care in hospitals.
Research approach

Many – if not all – hospitals struggle with this problem. While some hospitals are further than others, they see the potential for the future. Providing hospitals with new solutions to handle their efficiency and quality problems is the main goal of this research.

To find solutions to handle this problem an explorative research is conducted. A broad approach should give an overview of relevant aspects that determine the possibilities of tacit knowledge management and IT. The approach considers the primary processes in patient care. Using a multi-actor view, requirements, obstacles and experiences lead to conclusions and recommendations to the main question:

| Question: | How can hospitals manage tacit knowledge through IT systems? |

3.4. Case studies

As said, case studies fit into explorative research (Yin, 2003). During this explorative research, perceptions are gathered from the different actors. Since I emphasize these perceptions, theoretical definitions are less important for the case study. In the analysis (chapter 7), the perceptions is matched with theory.

Because of the limited scope of this research, researching all hospitals in the Netherlands would have been impossible. A selection has been made and two hospitals were chosen for a case study. The decision to research two hospitals was made because they represent both the academic hospitals and the general hospitals. I considered increasing the number of case studies; one option was researching two academic hospitals and four general hospitals. However, because of the limited time available a decision was made to research two hospitals in depth, instead of more hospitals with less detail.

Within each hospital, a few cases have been selected. The intention was to research implementations of knowledge management, however, these could not be found. The solution was to select other recent system implementations that had somehow to do with delivering information and knowledge. Around the cases, interviews have been conducted with involved actors (see 3.5).

The selected hospitals are quite representative for all the hospitals. To represent the academic hospitals the LUMC (Leids Universitair Medisch Centrum) was selected; and to stand for the general hospitals the MCRZ (Medisch Centrum Rijnmond–Zuid) was chosen. The academic centres are quite similar to each other; however, the general hospitals can differ from small (less than 800 employees36) until large (over 5000 employees15). The MCRZ represents the average of these hospitals in numbers with approximately 3500 employees.36 A same comparison holds for the number of beds, the financials and the specific health care services that are delivered.

3.4.1. LUMC

The Leids Universitair Medisch Centrum is an academic hospital delivering top clinical care. Many processes are already IT supported. Taking the next step in optimizing the IT infrastructure and implementing EPR allows the organization to start thinking about a more integrated approach to IT. The LUMC is characterized by its hierarchical structure and culture, with large distances between management and professionals. This leads to tensions between the different backgrounds. Professionals are occupied with patient care and medical policy, where management focuses on organizational policy.37 Because of the delivered top clinical care, there are high-educated professionals and strict protocols.
The five core tasks of the LUMC are:\textsuperscript{24}

- **Patient care** routine care, high-level clinical care, and in particular, high-level reference care.
- **Research** both fundamental (pre-clinical) and bedside (linked to patients), healthcare-oriented research.
- **Education** for the faculties of Medicine and Biomedical Sciences.
- **Specialist medical training.**
- **Additional training**, both post-doctoral and post-vocational.

Within the LUMC, three of IT implementations have been chosen to focus the case study\textsuperscript{19}:

- **Community site for IT reference architecture** An interorganizational community site between IT departments of eight academic hospitals, meant to share documents and knowledge to support a study after a common IT reference architecture.
- **Altrix** An internal communication platform and knowledge web for nurses. (Altrix)
- **Community site for dieticians** A community website in development.

### 3.4.2. MCRZ

The MCRZ is a general hospital for top-clinical care in the region south of Rotterdam. In the MCRZ, approximately 3500 employees deliver care to patients. The MCRZ has two locations (Clara and Zuider) because of a fusion between two hospitals. In a few years both locations of the MCRZ moves into a new building, which is currently being build.\textsuperscript{40}

The objective of the MCRZ is to become a member of the best 20 top-clinical hospitals. To reach this top, MCRZ should be come a teaching hospital, delivering medical specialist education. IT plays an important role here.

The system implementations that have been selected in the MCRZ are\textsuperscript{41}:

- **DKS-e** A system to store and distribute access protocols through the hospital.
- **PACS** A system to store and distribute digital x-ray photos through the hospital.

### 3.5. Interviews

After the selection of the two hospitals and the cases within the hospitals, respondents for interviews were chosen. Due to the time limit, 12 interviews in LUMC and 11 interviews in MCRZ were executed. The purpose of the interviews:

- Give an answer to the research questions about requirements, obstacles and experiences.
- Offer enough information about the different case studies.
- Shine a light on different perspectives (managers, professionals and nurses).
- Provide insight in the four components of the knowledge environment (organizational structure, competences, culture and systems).

The selection of representative persons to interview was difficult, but the results lead to satisfaction. Table 8 (LUMC) and table 9 show how the interviewed people represent managers, professionals, nurses and staff functions. Most people have besides their main function other function between brackets. This is because they represented also other groups, most managers for instance have had professional or nurse functions in the hospital. Therefore, they could give insights in more than just one perspective.
Research approach

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>Manager</th>
<th>Professional</th>
<th>Nurse</th>
<th>Staff</th>
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<tbody>
<tr>
<td>Karel van Lambalgen</td>
<td>Directeur Informatievoorziening en Automatisering</td>
<td>x</td>
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<tr>
<td>Robert Holl</td>
<td>Hoofd Kindergeneeskunde</td>
<td>x</td>
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<tr>
<td>Erik Flikkenschild</td>
<td>Directeur beheer</td>
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<tr>
<td>Hans van Raamt</td>
<td>ICT</td>
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<tr>
<td>Joan Meekel</td>
<td>Hoofd verpleegkundige</td>
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<tr>
<td>Caroline de Bes</td>
<td>Hoofd afdeling diëtetiek</td>
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<td></td>
<td>(x)</td>
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<tr>
<td>Marlies Lagendijk</td>
<td>Diëtist</td>
<td></td>
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</tr>
<tr>
<td>Lenneke Elderbroek</td>
<td>Diëtist / Manager Valent RDB</td>
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<td>Martine de Clercq</td>
<td>Vrijgevestigde diëtist</td>
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<td>Barbara Romsom</td>
<td>Teamleider Psychiatrie</td>
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<tr>
<td>Fennate Huiberts</td>
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<tr>
<td>Eveline van Loon</td>
<td>Verpleegkundige neonatologie</td>
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</table>

Table 8: Overview of interviews LUMC

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>Manager</th>
<th>Professional</th>
<th>Nurse</th>
<th>Staff</th>
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</thead>
<tbody>
<tr>
<td>Paul Smits</td>
<td>Voorzitter Raad van Bestuur</td>
<td>x</td>
<td></td>
<td></td>
<td>(x)</td>
</tr>
<tr>
<td>Mark van Aart</td>
<td>Directeur medische zaken</td>
<td>x</td>
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<tr>
<td>Rob Stevens</td>
<td>Directeur patiëntenzorg</td>
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<td></td>
<td></td>
<td>(x)</td>
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<tr>
<td>Frank Arnoldy</td>
<td>Directeur beheer</td>
<td>x</td>
<td></td>
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<tr>
<td>Tjeerd Caninus</td>
<td>Hoofd ICT</td>
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</tr>
<tr>
<td>Jeanet van der Stel</td>
<td>Stafmedewerker</td>
<td>(x)</td>
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<tr>
<td>Cees van Donselaar</td>
<td>Neuroloog (beleid EPD)</td>
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<tr>
<td>Tobias Bruning</td>
<td>Beleid extranet ICT en omgeving</td>
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<tr>
<td>Frederik Santman</td>
<td>Internist / intensivist</td>
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<td>H.T. Teng</td>
<td>Radioloog</td>
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<tr>
<td>Ronald van der Lely</td>
<td>Radioloog</td>
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</table>

Table 9: Overview of interviews MCRZ

During the interviews, respondents answered predefined interview questions. Interview ques-
tions were formed to gather answers to the research questions. The questions can be found in
Appendix III. Each interview took about one hour. The interviews were open and intended to
have the interviewed person talk freely about their requirements, obstacles and experiences for
IT and knowledge management. Each interview has been worked out in an interview report.42
This report was usually around four pages structuring the given information, but reproducing
the interview as well as possible. Each interview report has been send to the respondent, allow-
ing them to comment on the notions written down. All interviewed persons were asked to give
t heir approval that the interview report reproduced their opinions in the right way. Some inter-
viewees made slight changes, but everyone agreed on the reports.

The interview reports were analysed in separated groups of managers, professionals and nurses
for both LUMC and MCRZ. The tables can be found in Appendix I

- Table 12: Interviews MCRZ managers (Smits, Stevens, Van Aart, Arnoldy and Caninus)
- Table 13: Interviews MCRZ professionals (Van der Stel, Van Donselaar, Bruning, Santman,
  Teng, Van der Lely)
- Table 14: Interviews LUMC managers (Van Lambalgen, Holl, Flikkenschild, De Bes, Meekel)
- Table 15: Interviews LUMC professionals (Lagendijk, Elderbroek, De Clercq)
- Table 16: Interviews LUMC nurses (Van Raamt, Romsom, Huiberts, Van Loon)

The information from the tables is used to define the finding in the chapters 4, 5 and 6.
4. Requirements for the future hospital

"Imagination is the beginning of creation. You imagine what you desire, you will what you imagine and at last you create what you will."

George Bernard Shaw (1856–1950)

This chapter and chapters 5 and 6 present the findings of case studies. In these chapters, no references to literature are used to maintain clear what follows directly from the interviews. Chapter 7 however analyses the results of the case studies and link this to the theoretical problem exploration (chapter 2).

The case study starts with the identification of requirements for managing tacit knowledge and information systems, as requirements for the future hospital. All interviewed persons have been asked for their vision on how the hospital would look like in the future. In this future hospital for instance, all processes are optimally facilitated by information systems and knowledge is shared effectively to allow professionals to deliver the high quality health care. The requirements that have been found are split into the four groups of the knowledge environment: (1) organizational structure, (2) competences, (3) culture, and (4) systems. Main findings on each group are summarized here. For detailed information about everything said in the categories, I refer to Appendix I, where tables can be found through which the interviews have been analysed.

4.1. Organizational structure

The problem exploration and the research approach made clear that it is necessary to distinguish different views between management, professionals and nurses. Therefore, this section is divided – like the three other sections about competences, culture and systems – into these three parts.

4.1.1. Managers

The main objective of the hospital is to deliver the best quality of health care possible. This requires an efficient use of the available human resources, finances and systems. Interviews with managers in both hospitals show that this focus on the efficiency is the central issue. Increasing the efficiency allows reaching more quality with the available resources. Important issues as waiting times can be reduced and more patients can be treated.

Managers realize that IT is needed to reach this efficiency. Information systems can deliver the right information at the right time that allows professionals to make faster and better decisions. Managers understand the potential of knowledge management in this case, but do not see possibilities how to implement effective knowledge management.

At the MCRZ, management has set the special goal to enter the top 20 of clinical hospitals in The Netherlands (STZ). Being part of the clinical top hospitals is important to attract patients and show that an approved quality level is reached. Together with this quality goal, the MCRZ management set the goal to become a low-cost operator. These and other ideas for improvement are embed in vision 2012, which is currently being written.

Management at MCRZ underlined the importance of a flat organization with short communication lines. Last year, the division managers have been removed from the organizational chart to decrease the number of organizational levels. The medical professionals have been equipped...
with mobile phones so they can maintain short communication lines. For the vision 2012, management enters the discussion with professionals, because their vision on improvements and requirements

Managers at LUMC emphasize their function as an academic hospital to develop research and initiate new pilots. Their experiences and findings are important to improve continuously the health care system.

For all health care organizations in The Netherlands, counts that they have to co–operate to a larger extend. Pressure from the government – with rules to define health care operations (i.e. dbc’s) – forces organizations to coordinate health care operations together. Health care organizations have to make choices and define which health care is delivered where. Important hereby are agreements about patient transfers and the flow of patient information.

4.1.2. Professionals

For the professionals the quality of the delivered health care is the most important. The patient is central and health care processes should be optimal for the patient. This requires cooperation between the professionals inside the hospital and with professionals in linked organizations. Processes should be coordinated and executed in an optimal and similar way.

Developments in health care go very fast. Traditionally professionals are educated in a ‘gilde’–system. They learn in small teams how to super specialize in certain medical areas, it is called ‘super specialized’. Because of the development towards clinical pathways, the patient is being treated by much more professionals. Each professional is more and more sub specialized in parts of the traditional medical area. The traditional way of education doctors is not sufficient for the modern way of working, which requires cooperation and coordination between professionals. Besides the traditional clinical competence, ‘management’ competence is needed to ‘manage’ the medical processes along the clinical pathways (see also 4.2.).

The exchange of information plays a central role here. This can be done efficient by information systems, though the current systems lack real added value. How professionals see information systems is further explained in section 4.4.

Professionals at the MCRZ emphasized how information systems could make their work more efficient. They also explained the importance of short communication lines and a flat organization. Management and (IT) staff should be supporting towards the primary processes. A too directive attitude leads to conflicts (section 4.3).

4.1.3. Nurses

Like the professionals and management, the nurses see high quality of health care as their central objective. They are concerned about making less mistakes and delivering the similar treatment, by working according to strict protocols. The main differences with the professionals can be found in the acceptance of management and supporting staff as determining actors. Nurses work more hierarchically and routinely.

4.2. Competences

This section goes further into the requirements on the competence level. The primary assumption is that increasing competence is an important factor to deliver quality. In addition, competences like communication are needed for the exchange of knowledge. For the use of IT systems
specific IT competences are needed. The perspectives on competences from different actor perspectives can be found in this section.

4.2.1. Managers

Managers do not underestimate the importance of the competence of their employees. They are aware that increasing the competence leads to increasing quality. Moreover, increasing competence can lead to a decrease in the number of mistakes. However, competence is difficult to measure. In none of the hospitals, competence management is carried out. There is a limited insight in the competence of the employees, and in how to manage their competence. Current activities to increase the competence are limited to the recruitment of new higher educated and experienced personnel. Job rotations can be found in some scare instances.

Management at MCRZ is planning to turn the MCRZ into a teaching hospital. They are preparing more education activities for employees and students. This is an important criterion to reach the top of clinical hospitals in the Netherlands.

At LUMC, it is required for professionals to have extra educational and research skills. One manager indicated that – because of the fast developments – employees, who have the skills to learn fast, are more important than employees that know a lot. Communication skills are very important to be able to share knowledge. More than competence, a culture (see section 4.3) that makes knowledge exchange possible is needed. Culture and competences are closely intertwined. In a culture where mistakes are allowed as long as each mistake leads to a learning effect, the skills to communicate mistakes and learn from mistakes are required.

To do research, a set of mind is required that continuously looks for research possibilities. Professionals have to ask themselves the questions ‘what do I want to research’ and ‘how can this be researched’. Important at the LUMC are the writing skills to be able to publish the results of the research.

A final important notion is that investments are needed for improvements. For some large-scale improvements, the hospital might even be too small. Perhaps joined investments with other organizations are an alternative. This requires management to focus on the possibilities to improve the primary processes. Currently management is largely occupied with activities that do not have a direct influence on the primary process, like IT support or facilitate management. Realizing large-scale improvements requires a focus on the primary processes.

4.2.2. Professionals

The primary processes in the hospital are being carried out based up-on tacit and explicit knowledge. The availability of the right information about the patient and its medical history allows better decisions and faster working. Increasing the competence of the professionals leads to an increase in tacit knowledge and a better use of explicit knowledge and information. Faster and better decisions lead to faster and better health care.

In addition, a reduction of the time spent on decision making and administrative processes, allows the professional to spend more time on for instance personal contact with the patient. The results are a better and faster helped patient and a happier doctor, since the work processes of the professional become less of a routine. Interviews with professionals made clear that professionals generally would like to have more time for the special cases. Time saved on administrative and routinely processes can be spent to help those patients that have exceptional symptoms.
Professionals are aware of that delivering the right information at the right time allows for more efficient work results. The demand for information systems is in this light high. However, the current delivered information systems do not meet the expectations. Professionals – especially at MCRZ – respond less demanding upon knowledge management questions. In their perception, enough attention is already paid to education and knowledge sharing through meetings and presentations. The next chapter about obstacles elaborates more about the lack of visible added value of knowledge management. Professionals meet in workgroups to exchange knowledge in their profession. They are already forced to keep on following research developments in their research area. Seeing the real benefit of knowledge management is difficult for them.

At LUMC, the demand for knowledge management is higher, both internally and externally. Perhaps because of the larger organization and the specialized academic professionals, there is a faith in knowledge management systems. In addition, knowledge management systems that allow knowledge to be shared between organizations are requested. The pressure to cooperate and coordinate health care processes force professionals at the LUMC to share their knowledge with professionals in external organizations. To save time, the need for a system through which specific knowledge can be shared efficiently and effectively is large. Some initiatives are carried out to launch community web sites. While the demand for production, research and education is high, the LUMC cannot be a call–centre for required knowledge.

Knowledge exchange with clients is in both hospitals seen as extremely important. Patients require information about their treatments. Often brochures and other general information are available, but this information is not dedicated for the specific patient. The risk of misinterpreting information is large, for instance when searching the internet for information about a disease. Professionals understand that to exchange knowledge a similar level of knowledge is required at both sides. If one side (the patient) has a limited level of understanding, a precise translation is needed to transfer the information in the right way. This way of exchanging knowledge is time demanding and could very well be more efficiently achieved, for instance by using information systems, bed terminals and interactive brochures of information.

Tacit knowledge is what distinguishes professionals the most from each other. The skills and experiences to act upon this knowledge give the professional power. That especially this knowledge is so difficult to transfer creates the unique position of the professional. Not surprisingly, the professional is thereby a scarce good and an expensive resource in hospitals. Not all hospitals can afford to have all professionals available at any time. Most specialists are only occasionally needed and only large hospitals can afford to have these types of professionals available. Redundancy is too expensive, and this leads to the lack of expertise in many cases. Telemedicine is currently developing to allow professionals to make decisions over a distance. By sending x–ray pictures to a professional in another location, or allowing professionals at a distance to consult the patient through cameras, the scarce expertise and skills can be used even if the professional is not locally available.

4.2.3. Nurses

Nurses have a conservative research area.47 After education, nurses are not forced to follow developments in this area. Their competences are mainly defined by their study and their experiences in practice. Managers prefer nurse students that already during their study experience real patient care; the more theoretical studies deliver students that need a longer period to learn the practical skills. Competence of the nurses is of utmost importance to deliver high quality health care. This includes doing the right things, but also giving the patients the right information.
Nurses have indicated during the interview to be concerned about doing the same thing the same way. A standardized way of working is better for the patients and the quality of work. To reach a standardized way of working protocols have to be made. In both LUMC and MCRZ, this leads to difficulties, because nurses have differences in their way of working. Usually the way of working is heavily dependent upon the doctor that prescribes certain treatments; however, there is a large difference between professionals.

Supported by information systems protocols are being written. In MCRZ, nurses are forced to write these protocols themselves. Hence, they have to communicate with each other and investigate what the best way of working is. Often they have to look at other departments as well, to create uniform protocols. This reflection upon their own work processes in perceived as valuable, because the nurses understand how different departments work and how the relationships are. To ensure the quality of the protocols, writing and communication skills are needed. Once the protocols exist, nurses attach importance to work according these protocols.

Nurses generally have a demand for easier communication, since they work in shifts. There is a need for communication systems and perhaps knowledge management systems. Some nurses called the lack of IT competences as a characteristic for all nurses. However, others mentioned that most nurses have computers at home and have enough skills to work with the computer. More obstacles for communication and knowledge exchange are covered in the next chapter.

4.3. Culture

Often it is difficult to talk about culture and requirements in culture. Most people perceive it as something that exists, but is intangible or unchangeable. However, once helped with some examples most of the people interviewed realized the importance of culture for knowledge management and were able to identify both requirements (this section) and obstacles (as is covered in the next chapter) for culture.

4.3.1. Managers

Managers realize that quality in health care is not only a matter of the competence of the employees. Quality is also about the willingness to put effort into work done. Managers are in vein of a culture with a focus on quality. This culture is characterized by a patient–central view on working and a ‘learning’ culture. This learning culture is achieved by short communication lines between management and professionals and nurses. Direct communication allows managers to tell employees that they are the key to quality. Some managers try to create a culture in which making mistakes is allowed, as long as they are honestly communicated and there is a learning effect. In addition, a problem solving culture is seen as important. Once a problem has been found an attitude to try to solve the problem is better than a clash about responsibilities.

To increase the quality, knowledge sharing and IT are important. A culture in which knowledge is easily shared and a culture in which IT solutions are accepted are preferred. Especially the culture that is ready for IT leads to obstacles as is noted in the next chapter. Moreover, to reach knowledge sharing through IT, it is important that people know each other. Interviews showed that knowledge and information sharing systems do not work once the other party is unknown.

4.3.2. Professionals

The professionals have quite a similar view on culture as the managers. The differences that exist can be found in the IT culture. Professionals see IT as helpful, but they also see it as threat. Current IT solutions are less beneficial than expected and do not significantly reduce the time
spent on working. Solutions are designed by the IT department and do not optimally suit the professionals. Their acceptance for IT has therefore lowered, and they are more sceptical. Like-wise, professionals do not feel like becoming redundant because of IT systems taking over too much work. It is not a matter of losing the job, but mainly a feeling that IT reduces the quality. IT can never fully take over the complex activities of the human body and ethical aspects needs to be guaranteed by a human.

Others however, see the benefit of IT and see the possibilities for IT to take over the time-consuming routine work. Work can become more attractive when administrative processes can be automated. Also in favour of a better working culture are short communication lines and direct possibilities to contact everyone. A system that could help finding the right person, and might even reveal if this person is available or not, would save professionals a lot of time looking for the right information. Everybody saw the benefit of internet to share information and knowledge between professionals and university.

4.3.3. Nurses
Communication is an important aspect of culture, though, this is complicated because of the nurses working in shifts and the fact that many nurses work part-time. Nurses feel they are self-responsible to stay up-to-date. To stay up-to-date most of them appreciate using the computer and communication systems. In spite of this, there are usually just a few computers available. Nurses cannot afford spending a lot of time behind the computer, so more computers are not necessary with the current way of working. However, once IT marches on further and EPRs will be used, more computers will be necessary anyway. The required culture is one that is customer oriented with an attitude to improve continuously quality with all means available (including the computer).

4.4. Systems
According to the demarcation in chapter 2, for the system component of the knowledge environment the emphasis is one the IT systems. The interviews investigated requirements for IT systems for the future hospital from the three perspectives.

4.4.1. Managers
Managers expect a lot from IT systems that support the primary processes and optimize the communication in the hospital. They are willing to invest in a professional IT infrastructure and support. The first goal for IT is to make the primary processes more efficient. A very useful benefit is the possibility of IT to deliver management information. Based upon automatically generated key performance indicators, managers are supported in managing the organization and validating investments. In addition, government asks for key performance indicators for benchmarking between hospitals. Through IT, systems the administrative processes to get all this information can be reduced.

The first step the hospitals are taking now is towards an EPR. Through this system, the right patient information is always available at the right time. Because professionals have insights in the medical history of a patient, faster and better decisions can be made, hereby improving health care quality. One of the main IT expectations for the future is to automate clinical pathways (‘zorgpaden’) fully. These clinical pathways are aligned processes through which patients as an entity flow. Because IT predicts the chances that a patient needs certain follow-up processes, the following processes can be prepared. This leads to a reduction of waiting times and to a much more efficient use of resources in the hospital.
Managers see the benefit of knowledge management and effective information sharing through IT systems. Both can be very beneficial to the quality and the efficiency.

4.4.2. Professionals

The right information at the right time is necessary to deliver high quality health care. A good system is needed, but this does not need to be an IT system. Some professionals argue that when good logistics and paper work can provide the right information, there is no need for expensive information systems. Most professionals however, admit that for a real efficient distribution of information IT is required. IT can facilitate information flows and support communication.

Some professionals are further than others in seeing the possibilities for IT in the future. Some are quite sceptic about IT, seeing the current developments and the small benefit that is provided by current IT solutions. Others admit that the current way of working needs to be improved, but see that there is a huge potential for information systems to add value to their work. First of all the infrastructure, hardware and way of support needs to be professionalized.

Simple IT tools to relieve administrative processes or receive the right information are needed. Once IT is easy to use and has real added value to the professionals IT is welcomed. Some professionals see the need for large IT solution to streamline processes totally. These solutions can create clinical pathways that allow IT systems to monitor patients. In addition, there are solutions that support medical decision-making, based upon statistics in the patient population. These systems can guide the professionals in their decision-making by providing up-to-date probabilities and decision trees.

4.4.3. Nurses

IT systems are of increasing importance for work processes. Most nurses prefer an EPR to the current paper records. EPR forces to work more efficient and standardized. IT systems can also support communication. IT systems can therefore benefit in the quality of health care.

4.5. Requirements in managing tacit knowledge through IT

Gathering requirements from different actors in the two hospitals has revealed a broad spectrum of expected improvements. In this section, I come back to the central question in this research (How can hospitals manage tacit knowledge through IT systems?), by answering the second sub question (see chapter 3).

**Question** What are the requirements for managing tacit knowledge through IT systems from the three actor perspectives?

This chapter revealed the main requirements that followed from the case studies. I noticed that knowledge management and IT systems have a potential to improve efficiency and quality of the health care processes. However, there are only limited experiences with knowledge management implementations and IT is limited used.

There is a trend towards organizing processes in the hospital among clinical pathways. This more efficient organization of processes also increases the quality. Professionals sub specialize their activities and patients are being treated by more professionals. This requires more coordination and cooperation between professionals within and between organizations. The coordina-
tion and cooperation require new competences, like management and communication, from professionals. For these new competences, the traditional education is insufficient.

It followed from the case studies that a culture is needed in which all actors strive for improvements in efficiency and quality. For nurses that work with routines it is difficult to maintain a quality attitude. As we see in the next chapter, the current culture mistrusts innovations in IT systems. A culture that allows for changes is required. In practice, this requires a leading person that can exemplify the benefits from a project to the end-users. It is however difficult to maintain an eye for improvements when end-users do not have the necessary IT skills.

The delivery of the right information is a crucial factor to improve the efficiency and quality of patient care. Furthermore, IT can guide the clinical pathways and make processes more efficient. IT can streamline the communication and deliver management information. IT systems can benefit to codification and personalization strategies in knowledge management.

**Answer** All actors have generally high expectations and see possibilities for improvements of efficiency and quality by using IT systems. They listed requirements for the future hospital on the four components: organizational structure, competence, culture and systems. The three actors had slight different views on the requirements for knowledge management. Managers see the benefits of knowledge management for efficiency, but do not see concrete ways to implement it. Professionals are more concerned about receiving the right patient information to enhance the quality of the decisions. Nurses see less benefit in knowledge management solutions.

This chapter revealed the requirements that the respondents listed for managing tacit knowledge through IT systems. Together create these requirements a perspective of the ideal future hospital. However, behind every requirement there are obstacles. Again, in the same structure the next chapter uncovers all the obstacles behind the requirements from this chapter.
5. Obstacles on the way

This chapter continues with the case study results. It elaborates on the obstacles in reaching the flawless future hospital that grow in the previous chapter, because they form crucial barriers. Like the previous chapter, this chapter is structured using the four components of the knowledge environment: organizational structure (5.1), competences (5.2), culture (5.3) and systems (5.4). Section 5.5 summarizes the findings and answers the sub question:

What are the obstacles for managing tacit knowledge through IT systems from the three actor perspectives?

5.1. Organizational structure

Using the interviews, relevant obstacles have been identified on all components; here I summarize the main findings that have to do with the organizational structure.

5.1.1. Managers

The organization of the hospital is complex. In chapter two, the complexity was unravelled into technical and organizational complexity. The interviews revealed the importance of this complexity. It is very difficult to understand the complexity, but it is needed to get the organization going. It is even more difficult to steer such a complex organization towards improvements.

A specific complexity mentioned at the MCRZ was that the hospital was too much internally oriented. The fusion between two hospitals a few years ago has lead to many internal disputes, preventing the hospital from looking at its outside world. Management is currently focussing on creating a patient–central attitude and an eye for the external organizations that influence the health care processes.

The difficulties lay in the large gap between management and professionals. It lacks management the possibilities to steer the autonomous working professionals. Traditional command and control management is therefore impossible. If management would implement knowledge management or information systems, there has to be a real benefit for the professionals or the solution would be rejected. Because for knowledge management freedom is preferred, there is a dilemma for managers between allowing this freedom and trying to achieve command and control possibilities.

More general the complexity between organizations is also an issue at LUMC. The pressure to cooperate with external parties also increases the number of external contacts and external dependence. Communication and coordination between organizations is very difficult. There is no hierarchical structure, which blocks the possibilities for traditional management (command and control). The unrealizable need for competitive organizations to work together is a large obstacle.

Managers in hospitals see the potential of knowledge management but they do not know how to implement methods effectively. The pressure to solve issues that are more critical and a focus on information systems have lead to a situation where knowledge management is not yet implemented in practice. The need for knowledge management tools is not high because the profit is invisible.
Finally, there is a lack of financial means to invest in improvements. Many IT or knowledge management solutions are expensive and profits are invisible. The difficulty to calculate the business case is another reason for the failure of many projects. For some investments, the scale of the organization is too small.

5.1.2. Professionals & nurses
The right information available at the right time is the most important for professionals and nurses. However, the technical complexity and the required organizational coordination make this difficult to achieve. It is difficult to coordinate the work of the autonomous working professionals. Information systems can play a role but have many difficulties.

5.2. Competences
In general, missing IT competence is commonly mentioned as one of the main reasons why many IT implementations have failed and why new incentives to implement i.e. knowledge management systems are not taken. However, also other competence aspects form important obstacles to manage tacit knowledge.

5.2.1. Managers
Although managers realize the importance of competence for the employees, less effort has been put into making competences visible. In neither one of the researched hospitals, any kind of competence management existed. Competences are invisible to managers and to professionals that require competences from each other.

Management in hospitals is occupied with many problems that indirectly linked to the primary process (like facility problems). There is a lack of attention to improve the primary process. However, for many managers it is easier to solve facility problems than to communicate with professionals in order to improve their primary processes. Here we reach yet another obstacle: the large distance between management and professionals. Professionals mostly work autonomously from managers.

5.2.2. Professionals
Professionals often struggle with problems that are not exactly their area of expertise. It is difficult for professionals to find colleagues with certain competences, because there is no insight in these competences. In some cases telephone lists exists where professionals are listed, but not with their exact competences. If the needed professional is unknown, or simply not available at that time the competences are missing, while they might be available somewhere else.

Professionals miss the IT competence to realize the possibilities of IT to improve the processes. IT solutions have thereby mostly been invented by the IT department, where specialized IT employees work. The large distance between these two worlds and the differences in competences have lead to the situation that the IT department delivers IT solutions that are not accepted by professionals. Professionals perceive the proposed solution as user-unfriendly and do not see added value in the applications. Where IT professionals mention the unwillingness of medical professionals to change towards new situations, the medical professionals call the proposed improvements as unwanted.

In addition, professionals do not like IT staff or decision makers to take over their work. Therefore, they are resistant towards inventions from their side. Professionals are expensive, and especially for some competences very scarce. Small hospitals cannot afford to have all types of
professionals available. However, sometimes suddenly a special competence is needed. Someone with fewer competences is then going to make the decisions, leading to a large chance of mistakes. Redundancy in professionals is not accepted, because it is unaffordable and the only solution is to use IT systems for communication and telemedicine.

Following all developments in the research area is very time-consuming. Even though internet and e-mail facilitate the communication and the knowledge sharing a lot, professionals claim to have too less time available to follow all developments. The pressure to reach production quota is often stronger than the demand for learning. The result is less time spent on inventoring information. In addition, the knowledge shared is influenced by this lack of time.

Management at LUMC forces professionals to work on research and education. Professionals are willing to spend more time on research and education, but there is not enough time. Time needs to be spent on patients first, leaving no room for improving their work or their competences.

5.2.3. Nurses
Nurses work mainly physically and routinely, the working methods are traditionally fixed. The research area is undeveloped and relatively few new developments influence the way of working. This leads to a situation where nurses, once finished their education, do not study new developments anymore. Once slight changes occur in the way of working, there is no incentive to set a new standardized way of working. As a result, nurses that use different methods are not motivated to keep on following research developments.

Some nurses might lack enough IT skills to work with the computer; others argue that almost everyone is used to the computer at home. Especially the younger generation seemed to have the competences to work with the computer. The missing IT skills can be given in trainings. However, sending nurses to training requires other nurses to take over the work, leading to extra costs.

5.3. Culture
Culture is intangible – it just exists – but forms a main requirement for knowledge sharing. This section elaborates how managers, professionals and nurses perceive different problems in culture.

5.3.1. Managers
Management understands the importance of culture for knowledge management, and for the possibilities to implement IT. However, changing culture is a long process and it is very difficult.

In the LUMC the ‘not invented here’ syndrome was mentioned as important cultural blockade for new inventions. Good ideas from outside the organization are not accepted. A culture of believing that the best finding come from the own organization is an obstacle to get good ideas implemented.

Another obstacle mentioned at the LUMC was the need for one leading person to get things done. Traditionally all good ideas are attached to one person, as is the case in the research area. This is both a risk and an opportunity. If a leading person cannot be found, the chance of successfully implementing a good idea is somewhat small; with a leading person, an idea can be successful, with the risk of losing the idea when this person leaves the idea.
Obstacles on the way

At MCRZ, management named the missing collective memory as another specific cultural aspect. Because of a large number of recently added employees, and reduction of the employees that were working in the MCRZ for a long time, the MCRZ started to miss a common memory. This collective memory allow people to realize what they are doing and towards where the MCRZ is headed.

5.3.2. Professionals

Interviews showed a large gap between management and professionals. In addition, there is a distance between IT staff and professionals. Professionals work autonomously and the culture is characterized as hierarchic. This involves long distances between management and professionals and distances between different layers of management. Distances between professionals and between professionals and supportive staff are also significant. Solutions that are given by management or IT staff are only accepted if there is real added value. The low technology acceptance as mentioned before forms a crucial aspect of the culture. Professionals need time to get used to new systems. Especially because they are working under high-pressure to reach production. Professionals want to stay in control, and do not want decision-makers or IT solutions to take over their work. They want to keep the final decisions.

5.3.3. Nurses

Nurses work under a high pressure to increase the production and to reduce costs where possible. Their routine work and the fact that they work in shifts define the culture: a working culture. This culture of ‘no thinking, but doing’, does not allow for much reflection upon the work done. There is no check and control. This is an important obstacle to reach knowledge sharing and even more important to improve quality. The culture is hierarchic.

5.4. Systems

Hospitals are confronted with an old infrastructure, hardware and software. This is often said as the main reason that hampers the implementation of modern IT solutions. All actors perceive this, but there are also specific views on obstacles for systems that can support the primary processes and knowledge exchange.

5.4.1. Managers

Even though management is convinced of the possibilities of IT, it is difficult to calculate business cases. The real profits are hidden and the costs for IT come early and are high. The fact that the possibilities to invest are low leads to a stepwise development. Therefore, management is continuously looking for ways to improve the primary processes with useful cost-effective systems.

The complexity of IT is another reason why many IT implementations fail. Language used in IT is confusing and not univocal. In the LUCM, effort is being put into developing a reference architecture for IT, but this is difficult to achieve. This architecture should make clear what is what in IT. Linked to the complexity in IT language is the project language. Even though some project teams have been schooled in i.e. PRINCE2, others do not talk a standardized language of project management.

Management information is an absolute need-to-have for managers. However, management information is difficult to realize because of the technical and organizational complexity. There is a broad spectrum of applications that all have different software vendors and require different approaches to distract the wanted information. It is difficult to realize management information,
which involves responsibilities from many persons in the organization, also from an organiza-
tional point of view.

One of the reasons that knowledge management is not implemented in hospitals is the per-
ceived need for knowledge management systems and the lack of real visible benefits to prove
the profitability of the investment in such systems.

5.4.2. Professionals

Professionals lack the enthusiasm for new IT projects and new systems. Too many unsuccessful
implementations have lowered the technology acceptance of the professionals. Missing IT skills
are only part of this low technology acceptance.

Professionals add that face–to–face contact is important for knowledge transfer. To give the
right nuances and to see in which situation the other person is, it is important to look each other
in the eye. The chances of misinterpreting information are large. Video conferencing technolo-
gies can to some extent replace direct contact. Since typing and other ways of entering informa-
tion into the computer is to slow, the professionals prefer communication as direct as possible.

Not only the technical dimension of the different systems forms an obstacle, it is also the
organizational complexity of the different ways of working. The lack of standards makes inte-
gration or integrated solutions very complex.

5.4.3. Nurses

Like the professionals, the nurses have a resistance against large IT projects, mostly because
they see it as a source for extra work. Currently many systems (most of them on paper) require
lots of information to be written down. This overkill of information needs to be interpreted. New
information systems can be beneficial to reduce this administrative balance and for instance give
a clear overview. However, the tacit resistance is still, in some cases, visible.

Especially at MCRZ, at most places there are not enough computers available. At LUMC there are
more computers available, though if an EPR is put into use, more computers will be needed at
most places here as well.

5.5. Obstacles in managing tacit knowledge through IT

In this section, the findings from chapter 5 are summarized in an attempt to provide an answer
to the third sub question of this research:

| Question | What are the obstacles for managing tacit knowledge through IT systems from
the three actor perspectives? |

Almost all obstacles in this chapter are linked to the main barrier of complexity. Complexity in
technology exist among others in the large number of systems and applications, the old infra-
structure, the difficulties in IT language and the large possibilities of IT improvements. On an
organizational level, we saw complexity occur in the large distances and differences between all
the different actors in the hospital (managers, autonomous professionals, nurses and IT staff).
Furthermore, complexity exists because of the differences in way of working and the necessary
coordination and cooperation within and between organizations.
Obstacles on the way

Moreover, important obstacles proved to be the lack of financial means to invest in IT and knowledge management. One of the reasons for this is the impossibility to complete calculate the business case. The impacts of implementations are large, partly invisible and cannot totally be expressed in money-units.

Cultural aspects such as a tacit mistrust for new implementations, a low technology acceptance and a 'not invented here' syndrome, further block the possibilities for new improvements. The lack of insights in the added value from applications and the experiences with previous failed projects are the reasons for this. Culture is, together with competences, also an essential element in noticing possible improvements. To see ways to improve the current primary processes an eye for quality and efficiency and the competences to know how IT can provide solutions are needed. The lack of IT competence and knowledge management insights under managers, professionals and nurses, and the missing insights in the primary processes under IT staff form important obstacles.

**Answer** All actors perceive that the differences between them create large obstacles. The technical and organizational complexity in the hospital makes it difficult to implement new solutions. Obstacles in organizational structure, competences, culture and systems have been identified. All together, these obstacles create large barriers to implement both knowledge management and IT systems.

This chapter has identified obstacles for knowledge management, information exchange and the implementation of IT systems. The interviews showed that the success of an application is not the technology, but the correct use of the system by the organization. A system without visible benefit that is not carefully embedded leads to failures. The next chapter evaluates this statement with examples and experiences from practice.
6. Experiences in two hospitals

Based upon the interviews, the previous chapters revealed how the ideal future hospital would look like (chapter 4), and which obstacles are on the way to reach this (chapter 5). This chapter covers some experiences in dealing with these obstacles. Because there is a significant difference between experiences in the academic hospital (LUMC) and the general hospital (MCRZ), these two hospitals are handled separately, starting with the LUMC.

6.1. LUMC

The LUMC is an academic hospital that is expected to be further in research and developments than the general hospitals that are focussed on production. Within the LUMC, the following three cases are explored (see textboxes alongside this chapter):

- **Dietician community website**, for dieticians (professionals)
- **Altrix**, communication platform for nurses
- **IT reference architecture** community site for IT department

To stay compatible with the previous chapters the experiences are analysed upon the four aspects of the knowledge environment (organizational structure, competences, culture and systems) and the important differences between the different actors (managers, professionals and nurses).

6.1.1. Organizational structure

**Case: Dietician community website**

The LUMC dieticians need to reduce the number of patients and redirect patients towards the first line dieticians. However, to realize this redirection of patient the professionals need to coordinate and cooperate. To send a patient to another dietician one needs to know each other. In addition, knowledge needs to be transferred from the LUMC to the first line dieticians.

To facilitate the processes of getting to know each other, the knowledge exchange processes, and the coordination between dieticians, the LUMC started the initiative for a community website. This community website should play an important role in the transmural network between dieticians.

**Managers**

No changes in the organizational structure have been uncovered in the interviews. The only experiences here are with the transmural network for professionals.

**Professionals**

To facilitate the building of a transmural network between dieticians in the region around the LUMC and the dieticians in the LUMC, a community website has been created. This community website provides possibilities for discussion through a forum, but this function is not yet used. The founders of the community site are looking for ways to stimulate professionals to use this way of communication. The community site is mainly used to maintain a list of addresses from all members of the community site. Yearly meetings are held to get to know each other. The steering committee of the network has put the goals of the network and the activities online.

Making the community site work is difficult. It is not because of the fact that there is competition between the organizations. Knowledge is openly shared in favour of the patients. The common
Experiences in two hospitals

goal to arrange the best for the patient is strong. However, the real exchange of knowledge still needs to take place. Obstacles have been mentioned in the previous chapters. An important experience is that professionals in different organizations have their own ways of working and changing this is difficult.

**Case: Altrix**

Altrix developed for the communication between nurses. Because nurses work in shifts, it is difficult to communicate. Altrix consists of an online discussion forum on which messages can be posted and a calendar on which activities can be listed. Furthermore, there are links and other relevant information available for the department.

Altrix has been developed by a nurse with IT skills. Altrix became immediately a success. It is now professionally supported and implemented in most of the departments in the LUMC.

**Nurses**

The implementation of Altrix made clear that automating work-processes starts bottom-up. Useful initiatives have been developed by nurses instead of IT staff. Nurses know what they want and can give suggestions for improvements. Obstacles as identified in the previous chapters, once again, play an important role.

6.1.2. Competences

**Managers**

Management at LUMC tried to link salary with competences and expected behaviour. This is easier for staff than for professionals. In addition, new employees are recruited with the important competences. They are:

- Communication and teamwork competence
- Competences to take initiative and solve problems
- Writing skills
- Competences to manage emotions
- Learning and teaching skills and attitude

Management of medical professionals expects effort for research and education from professionals, in addition to their patient work. Especially research needs attention and a continuous searching for is necessary to research.

For management it is important to be able to learn quickly. Nurse students with experiences in practice during their study learn faster than theoretical students without practical expertise. Because of the fast developments, it is more important to be able to learn than to know a lot.

**Professionals**

Professionals stay up-to-date about developments in their research area by using mailing lists and forums. Professional workgroups, with professionals from different hospitals, have been formed that meet occasionally, but have regular online contact.

In order to exchange knowledge between dieticians in different organizations once a year network meetings are held. In these meetings, subjects are discussed. The meetings proved to be an effective way to get to know each other and share knowledge. A list of participants can be found at the community website. However, their real competences are not listed. A speciality does not give enough information about all competence behind it.
**Nurses**  
The way in which Altrix is used shows that many nurses have computer skills, and that the ones that do not possess this competence learn fast because of the enthusiasm of their colleagues. A nurse with IT advanced competence proved to be very useful to develop IT solutions that suit the demand.

**6.1.3. Culture**

**Managers**  
Managers at LUMC realize that clear roles and responsibilities are important to create a culture in which people take initiative to solve problems. A problem solving culture is created by sharing information about organizational goals. Moreover, making mistakes can be allowed as long as there is a learning effect from each mistake. This requires open communication about mistakes; an open culture is of utmost relevance. Culture is in this perspective very much related to competences and competence management is therefore important.

**Professionals**  
The professionals need to tell each other about the community website to make it work and motivate each other to stay up-to-date. This should also come from management. A leading person is required to make other people use it. A lack of leading persons was one of the reasons why the community site for the IT reference architecture failed.

**Nurses**  
Altrix has lead to a successful use, because it was a real and simple solution for communication problems. Subjects can be discussed online and there is less need for regular meetings. This saves time for the nurses and is very useful for management.

The creation of an own system between the systems of the hospital has lead to resistance in the IT department for the new unknown system. Management intervention was needed before the new system could get sufficient support from the IT department.

**6.1.4. Systems**

<table>
<thead>
<tr>
<th>Case: IT reference architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Since IT language is complex and far from univocal, the eight academic hospitals in Holland decided to make an IT reference architecture. This architecture should make clear where each IT term stands for. This would clarify the communication between hospitals and the communication with for instance IT vendors.</td>
</tr>
</tbody>
</table>
| To develop the IT reference architecture a community website has been launched, however, this community website has not been used by the IT professionals that were developing the reference architecture, even though the idea had enough potential. |}

**Managers**  
The LUMC is professionalizing its IT infrastructure and IT support. A better IT infrastructure is needed for i.e. the PACS project. To professionalize the IT support ITIL--standardization is used. This involves that supportive processes are registered in the application TopDesk. Moreover, project management needs the same standardization (i.e. PRINCE2).
Experiences in two hospitals

**Professionals**

The professionals at LUMC realized the potential of a community website, however due to a lack of time and the user-unfriendliness they do not use it yet. To make the community site work no parallel systems, like e-mail, should be used for communication.

**Nurses**

Nurses use IT in different ways:

- The Internet is used to search for relevant work-related information
- The intranet of the LUMC (AlbinusNet) is used for local information and for reading protocols.
- Nurses use e-mail and Altrix for communication

Although there are not always enough computers available, they try to check Altrix and e-mail at least once every shift.

Working with an EPR has been explored at some places in the hospitals and is said to be very user-friendly. An EPR prevents mistakes and increases the quality because of a standardized way of working.

6.2. MCRZ

The Medisch Centrum Rotterdam-Zuid is a hospital for top-clinic health care. Being a different hospital, they are not competing with the academic centres. MCRZ is currently renewing their IT-infrastructure to allow more professional IT-support. Taking the step to tacit knowledge seems far away, but it can be a competitive advantage to take it soon. Within the MCRZ to special implementation have been analysed (see textboxes):

- **PACS** a system for digital x-ray pictures
- **DKS-e** to store and distribute protocols online

6.2.1. Organizational structure

**Case: PACS**

A Picture Archiving and Communication System allows taking digital x-ray pictures, storing and distributing them digitally through the hospital. The radiology department where x-ray pictures are taken is essential to the hospital. Because formerly x-ray pictures needed to be transferred between departments and locations this has lead to delays and losing pictures. By storing pictures digitally both environment and costs can be saved and the patient receives a smaller amount of radioactive beams.

The success of PACS is clear for the radiology department. However, because of slow and user-unfriendly end applications for the medical professionals in other department the real benefit is missing. Due to high costs and invisible savings, there is no consensus about the success of the application for the hospital.

**Management**

Management at MCRZ is writing a vision for the coming five years, called vision 2012. The vision includes four main goals: increase the market share, improve patient satisfaction (quality), operate at low costs, and risk management (less mistakes). The organization is looking for ways to reach and measure the improvements of these goals in 2012. Key performance indicators are needed, but these are difficult to acquire from the results of health care processes. The MCRZ needs this information for management, and for publishing it in favour of external responsibilities.
The MCRZ went through many changes in the last years. The organization was almost bankrupt two years ago, and a large reorganization had to take place. In the last years the hospital reorganized, leading to a large number of employees leaving the organization and new employees being recruited. Management at MCRZ made the organization less hierarchic by removing the division managers. With a new management structure, the MCRZ is now looking forward to 2012.

To gather input for this vision the management talks with employees throughout the organization. The operating core needs to indicate where the hospitals are heading. Therefore, regular meetings are held with professionals. One of the goals set is to become a member of the organization of top clinical hospitals (STZ), positioning themselves as a high quality teaching hospital.

Other experiences are the formation of a client panel that evaluates the supporting staff. A number of reprehensive employees give their opinion about staff solutions.

**Professionals**

Another way, that has proven to be successful, to tighten the gap between supporting staff on the one hand and professionals on the other hand, is the formation of an IT commission. In this IT commission, professionals represent their wishes for IT developments. The commission plays an important role in initiating and evaluating IT projects. Three program managers are part of the IT commission:

- The program IT and the hospital (the internal organization)
- The program electronic patient records (EPR)
- The program IT and external relations

**Nurses**

Because nurses work very routinely inside their own department, they are generally less aware of what happens around the hospital. Their working methods, in some cases, might unintentionally influence other nurses in their work. The project to have nurses writing their own protocols in the DKS-e system, forces nurses to look further than their own department. Communication between nurses leads to new insight in possible improvements. Of course, difficulties occurred, because of differences in the working methods.

**6.2.2. Competences**

<table>
<thead>
<tr>
<th>Case: Document quality system (DKS-e)</th>
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<tbody>
<tr>
<td>The ‘document kwaliteitssysteem’ is implemented to facilitate the storage of protocols. Once protocols are centrally accessible for everyone, it is possible to talk about following protocols and hereby delivering quality. Quality can be reached through a standardized way of working, laid down in these protocols.</td>
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DKS-e has been launched recently. Nurses themselves had to write the protocols, they had to reflect upon their own work and write down how care processes can be executed the best way.

**Management**

Since management realized the importance of competence, a few measures have been taken to improve it. First, a department of education has been formed, to guide the hospital towards a teaching hospital. Second, new personnel with appreciate knowledge levels has been recruited for certain management and staff functions. Third, managers have been trained.
Experiences in two hospitals

To use competence more efficiently, the management wants to focus more on the primary processes instead of the corporate, facilities and finance management. Instead of only concentrating on production and costs, managers wish to improve the quality of the health care processes.

Another management intervention was the formation of an internal consultancy department for IT projects. When an IT project needs a project manager or consultant, they can be taken from an internal pool of consultants. The employees in the pool focus on standardization of project management (i.e. PRINCE2) to share knowledge effectively.

**Professionals**

Even though competence management is not an issue as such, there are different ways to efficiently deal with the existing competences. For medical professionals i.e. the professionalisms have been listed on paper cards. Together with pictures and telephone numbers, this is an efficient way of contacting each other.

**Nurses**

Nurses are stimulated to follow new developments, and meetings have been organised around special themes to discuss work–related issues. From 2010, government will demand nurses to follow regularly extra studies besides their work to maintain their big–registration.55

**6.2.3. Culture**

It was difficult to require cultural experiences. Some IT managers indicated that they motivate their IT personnel to go visit and look at the primary processes. They found it important to reduce the distance between the IT staff and the medical professionals. The managers tell their employees how the IT department should be facilitating the primary processes and the organizational goals.

Another attempt managers tried was to communicate with professionals and nurses about quality. They tried to create a quality attitude by stating that the professionals and nurses are the key to quality. Quality is how the patient experiences the health care and this is mostly related to the work delivered. Because of the high pressure on production and costs and the administrative ballast, it is difficult to put extra quality into work.

Communication is also an important issue when implementing new systems. Implementations of PACS and DKS–e showed that professionals and nurses are more willing to work with the application when they understand the value that is added by the application. The technology acceptance was further increased by creating representative teams of users, who stated the requirements for the new system (PACS).56

**6.2.4. Systems**

**Managers**

For an optimal use of the potential of IT, the first steps are to professionalize the IT infrastructure and IT support. Measures taken are renewing of servers and applications, reducing the number of applications, a standardized (ITIL) way of handling IT support requests and a renewed intranet. Especially this new intranet would give the organization new possibilities for communication.
Another development is the preparations for an EPR. Many different applications need to be linked or replaced. An EPR is both an organizational and a technical challenge, but is extremely important for the right information delivery and further steps in IT development.

Once the basic IT requirements (infrastructure, support, and EPR) have been realized, the MCRZ can look further into the developments towards aligned health care processes, the generation of management information and support of the primary processes (including decision making). Especially the latter is still far away.57

For the implementation of systems for nurses, it proved to be important that line managers support the system. For the nurses the line managers are their representatives towards top management. If strategic management enforces new IT solution, visible enthusiasm of the line managers is crucial for enthusiasm under nurses.

**Professionals**

A good improvement was equipping the professionals with mobile phones, making them easy to reach. However, the implementation of PACS has lead to some experiences where professionals see IT developments as less positive. Even though the application has been successfully implemented – apart from some bugs – in the radiology department, the other departments have to work with an external viewer. This external viewer is very user-unfriendly and slow.58 Where professionals in the radiology department have been equipped with large high-resolution screens, the external viewers have to use regular small screens. The radiology department is very satisfied with the system and recalls many advantages (less production costs, less transportation costs, no picture-loss, the patients gets less radioactive beams, etc.).

The application has typically been designed with only a few users in mind. The result is dissatisfaction with the system under most of the users. Profits are only found in one department. It is difficult to weigh these profits against the costs of the application and the extra effort needed from other departments working with the external viewer. This lack of benefit for all users is typical for most applications in the hospital. Because of the hidden costs and profits, a business case is difficult to calculate.

To support the professionals in the radiology department, an internal helpdesk has been created. This helpdesk proved to be very useful for a successful implementation in the radiology department. Such a helpdesk has not been created for the external users, leading again to extra frustration. When finally a lack of standards between PACS systems in different organizations creates a situation, where professionals cannot exchange pictures with each other, it is difficult to call the implementation a success.

**Nurses**

The creation and storage of protocols in the system DKS–e has lead to interesting learning effects under the nurses. Critical reflection upon the work processes has created useful protocols to deliver higher quality care. The nurses have been trained to facilitate the writing of protocols, both writing and analysing skills have been taught to teams of nurses. At first teams were formed of nurses from the same discipline. However, soon management found out that education in multidisciplinary teams had more effect, because better insights in each other’s processes were reached.
Experiences in two hospitals

The motivation for the new DKS-e system grows when examples of how the system reaches more quality for the patients are shown. The IT department is working to make the pc look like pc at home. This is important in order to get nurses to work with computers.

6.3. Experiences in managing tacit knowledge through IT

Based on the interviews, this chapter has investigated the experiences in knowledge management and IT implementations, in an attempt to answer the fourth sub question of this research.

**Question** What are the experiences in dealing with the obstacles for managing tacit knowledge through IT systems?

As can be expected from an academic hospital, the LUMC is generally a step ahead in IT implementations than the general hospitals. Respondents at the LUMC acknowledge the role of an academic hospital to pilot and try new applications. However, no real implementations of knowledge management systems have been found. The fact that is was difficult to talk about knowledge management and the aspect of tacit knowledge, made clear how these concepts are still uncovered in the hospitals. Most emphasis in the interviews has therefore been on the IT systems that allow for the exchange of information. Some IT systems supported the communication in such a way that they can be seen as facilitative to knowledge exchange.

**Answer** No implementations of knowledge management have been found in the hospitals. Some implementations of different IT systems have been explored. Important experiences are the successes of bottom-up developments, the need for leading persons, the importance of training and support, the unexpected and large consequences, and the involvement of end-users in the development trajectory.

It can be concluded the success of implementations is not about technology but about organizational embedding. The real added value is difficult to predict, while at the same time the prediction and exemplification of the benefits are essential for success.
7. Analysis

Hospitals are faced with an urgency to implement IT and knowledge management. However, many IT-implementations have failed and knowledge management is as such not yet implemented. Reasons for this have been identified during the theoretical problem exploration (chapter 2). One of the main reasons is the complexity of the hospital, both in an organizational and a technical way. The different actors have different views on IT and knowledge management. IT departments deliver solutions that do not achieve the expected added value. The primary processes in the hospital are knowledge intensive and require knowledge professionals and nurses. Their knowledge is a complex mixture of tacit and explicit knowledge.

In this chapter, the results from the case studies are analysed and linked to the theoretical problem exploration. I will first (7.1) analyse the most important findings of the previous three chapters (requirements, obstacles and experiences) by comparing them. Then, I link the results to the concepts of the knowledge environment (7.2) and the different actor views (7.3). The last sub research question is answered in the end of this chapter, before the next chapter finally answers the main research question.

7.1. Analysing case study results

The previous three chapters have identified the requirements, obstacles and dilemmas as they can be found in Appendix I. This section analyses the main conclusions of these chapters linked to each other.

7.1.1. Requirements

Chapter 4 concluded the investigation of requirements with the following statement:

Requirements All actors have generally high expectations and see possibilities for improvements of efficiency and quality by using IT systems. They listed requirements for the future hospital on the four components: organizational structure, competence, culture and systems. The three actors had slight different views on the requirements for knowledge management. Managers see the benefits of knowledge management for efficiency, but do not see concrete ways to implement it. Professionals are more concerned about receiving the right patient information to enhance the quality of the decisions. Nurses see less benefit in knowledge management solutions.

Heading for an improvement in quality and efficiency, everyone agreed on the importance of information and knowledge. All respondents agreed that IT, in many ways, could increase the efficiency and quality of the processes. Especially the managers saw added value in knowledge management, but they did not have any insight on how to implement it.

Some respondents indicate the possibilities of IT based medical processes. Once all patient information is available through an EPR, the next steps can be taken. Health care processes can be structured into clinical pathways and processes can be aligned. Based upon up-to-date statistics of the patient population and decisions trees, medical professionals can be supported upon their decision-making. This would, in most cases, lead to faster decisions, leaving time for the patients that require special attention. Under more difficult circumstances – when too many factors play a role to support the decisions – the professionals can call upon their tacit knowledge. Of
course, the professional will always take the final decisions, since the complexity of the human body can never be fully trusted to IT systems. Finally, to guarantee that decisions will be taken ethically, a professional will have to stay in control of the final decisions.

7.1.2. Obstacles

In chapter 5, the obstacles have been investigated:

| Obstacles | All actors perceive that the differences between them create large obstacles. The technical and organizational complexity in the hospital makes it difficult to implement new solutions. Obstacles in organizational structure, competences, culture and systems have been identified. All together, these obstacles create large barriers to implement both knowledge management and IT systems. |

Many different applications and IT systems from different vendors, combined with an old IT infrastructure and relatively small IT support create a technical complexity for implementing new systems. The old computers, user–unfriendly systems and possibilities to enter information combined with small screens make the computers unwanted for the professionals. They do not see the added value of applications.

The organizational complexity inside and between organizations that have to cooperate is another large obstacle for new implementations. Professionals usually work autonomously and have differences in their working methods. The differences between organizations are also large.

In addition, management, professionals and nurses are missing IT competences to work with new applications and to see possible improvements. Although most people have a pc at home, clinicians seldom have more than the basic computer skills. “Nurses are no computer nerds.” The culture is characterized by a working culture, where professionals and nurses are under pressure to operate at low costs and increase the production. This form of routine work reduces the possibilities for a quality attitude.

We saw that a large gap exists in organization, competence and culture between the IT department and the professionals. This leads to failures in system implementations, because of fewer added values than expected. The ‘not invented here’ syndrome exists, as mentioned earlier. It proved to be very important that a new system or idea was developed within the own organization, or even better the own department. The most successful cases have all been developed inside the department. If the developments do not take place internally, solutions are likely to be rejected.

The business case for IT is hard to develop. Costs come soon, but profits are invisible. The budgets for IT developments are getting larger, but leave no room for real large implementations. All these obstacles lead to a situation where improvements are difficult to achieve.

7.1.3. Experiences

Chapter 6 reviewed experiences in the two hospitals:
Experiences No implementations of knowledge management have been found in the hospitals. Some implementations of different IT systems have been explored. Important experiences are the successes of bottom-up developments, the need for leading persons, the importance of training and support, the unexpected and large consequences, and the involvement of end-users in the development trajectory.

The LUMC is a step ahead of the MCRC, as can be expected from an academic hospital. More computers, and more digital work processes are used. However, many IT applications did not really save time and can be made much more efficient once they are linked.

Experience showed that successful IT implementations have been developed bottom-up. Successful implementations are not about technology but about implementations. It also showed that IT implementation need a leading person, preferable one from within the own group. It is often difficult to establish the success of an implementation, because of the many unforeseen consequences. Other end-users, as well as the expected ones, are critical for the success. Involving the end-users is therefore extremely important.

7.2. Analysing the balance in the knowledge environment

In chapter 2 the concept of the knowledge environment (Van Oirschot, 2003) has been introduced. Based up on the four aspects of the knowledge environment the case studies have been analysed. I have analysed the main findings:

- **Organizational structure** The most reoccurring issues here were: the complexity of the organization; the distances between management, autonomous professionals, nurses and the IT department; cooperation inside and between organizations; and the reorganization using clinical pathways.
- **Competences** We saw the importance of competences for quality and efficiency, the new required competences for management of clinical pathways, and needed IT competences to work with IT application and see possible IT improvements.
- **Culture** Aspects were indicated like technology acceptance, tacit mistrust, hierarchical culture, the 'not invented here' syndrome, and a patient central attitude.
- **Systems** There are many possibilities for IT to support the primary processes: IT as a communication tool, IT to deliver information, IT to support decision making and IT as a monitoring and alarming system when using clinical path. At the same time, this research indicated the lack of benefit in current solutions.

The assumption of the model is that to create the right knowledge environment there should be a balance between the different components. In the covered case studies, this would imply:

- **Organizational structure and competences** Hospitals turn into a new organizational form, organized around clinical pathways. This requires the competence to coordinate and cooperate from professionals, and therefore a form of management competence as well as clinical competence.
- **Organizational structure and culture** A flat organizational structure could for instance go with a non–hierarchic culture. We have seen how sub–cultures evolve within hospitals. For instance, the creation of a nurse sub–culture enlarges the gab with other departments, like the IT department or the professionals.
- **Organizational structure and systems** The IT department should be supportive to the organizational goals. In practice, this means that IT staff waits for requests. The large distance between the professionals and IT in practice is unbalanced with this.
• **Competences and culture** Competences and culture are both needed in order to deliver quality. One need to know how to deliver quality and an attitude to deliver quality, directly linked to culture, is necessary. Competence defines culture, and culture can stimulate employees to gather competence, for instance in teaching each other. The traditional way of educating professionals in relatively closed ‘maatschappen’ conflicts with the expected culture of openness and transparent key performance indicators.

• **Competences and systems** If advanced IT applications are preferred, the appropriate IT competence is needed. When professionals do not have the needed IT competence to see improvements, IT staff is needed for innovation.

• **Culture and systems** A culture in which IT systems are accepted can (more or less) be created by management.

Above I showed how the different components relate to each other, by using results from the case studies. In addition, literature provides examples for the relation between organizational structure, competences, culture and systems. The assumptions of the model are acknowledged by the case study results: the balance between the components of the knowledge environment is what really defines the knowledge environment.

### 7.3. Analysing differences in actor views

In chapter 2, the decision was taken to research the differences between managers, professionals and nurses, because of their importance and their different views on the research question. The choice was made using Mintzberg’s actors and his assumptions of the professional bureaucracy. The knowledge environment model was extracted with an extra dimension, and interview respondents have been selected to represent the different actor views.

#### 7.3.1. Managers and professionals

The results of the case study generally acknowledge the structure and assumptions of Mintzberg (1983). The case studies showed how management struggles with the typical autonomy of the professionals. In both the LUMC, where professionals are part of the organization, and the MCRZ, where professionals have their own ‘maatschappen’, managers had a certain degree of control over the professionals. A too directive attitude leads to conflicts (section 4.3).

De Bruijn and Ten Heuvelhof (1999) describe how management lacks the possibilities for steering through a traditional way of command and control. They provide solutions for management to steer by using a process approach. De Bruijn and Claire de Nerée tot Babbereich (2000) indicate a number of dilemmas for knowledge management in these situations and solution to deal with these complex situations. De Bruijn, Ten Heuvelhof and In ‘t Veld (2002) give solutions for management in an interorganizational network, through a process approach. The case study interviews indicated the significance of these theories. Management in both hospitals indicated the need for these approaches to get things done, both within their own organization and within a network of organizations.

#### 7.3.2. Professionals and nurses

There is another important difference between professionals (doctors) and nurses. The assumption that these two groups have different perspectives on knowledge management was not exactly measured. However, it can be said that professionals saw more benefits of knowledge management and IT systems, compared to the nurses. Managers also indicated that doctors could handle changes better than nurses could.\(^6\) This is mostly related to their competences and the fact that they are higher educated. Even though the autonomy of the professionals can create
difficulties, compared to the more hierarchal steering possibilities on nurses, this group is more changeable. Important here is in addition the willingness to change towards a new situation. For both actors counts that the system should add value, which in most cases means saving time and effort.

In general, the different actors have the same goals: improving the quality of health care and establishing working methods that are more efficient. The differences found are linked to the fact that managers are more aware of competition and of operating at low costs, when professionals care more of the benefits for their own way of working, and nurses want to ensure that the patients receive the adequate patient care. It followed from the literature research in chapter 2 how this has consequences for the implementation of knowledge management and IT. The case study acknowledges these consequences. For management the implementation of knowledge management and IT systems should make the process more efficient, but it should still be manageable. Professionals need added value, like saving time, in their processes. Nurses see less benefits of knowledge management and IT systems for their processes since their work is mostly done by hand. However, when implementations add to the quality of patient care they are willing to change.

The next chapter concludes this analysis and use the different perspective in the recommendation given.

7.3.3. IT staff
The decision to analyse three different actor perspectives and neglect the IT staff perspective was made in chapter 2. The question arises if, after analysing the results of the case study, the IT department is missing as an extra actor. IT determines the constraints in which IT applications can be implemented. The increasing importance of IT in the hospital is generally accepted. The IT department will grow in size and in importance for the primary processes in the coming years. Researching the IT department could therefore have been valuable.

However, due to the limited time available for this research, the IT department was not analyzed separately. Within these possibilities, it was already overwhelming to research three actor perspectives. It followed that the IT department lacks the power to make decisions in the hospital, since their role is supportive. The distance and differences between the IT department and the organization are perceived as large. Many IT implementations failed, because of missing insights in the requirements of the organization. Following this conclusion, I argue that insights in the organization are more important than insights in the IT department.

7.4. Relations to literature
Apart from the knowledge environment (section 7.2) and the differences in actor perspectives (7.3) that formed the structure of this research, some other relevant concepts have been introduced in the theoretical problem exploration (chapter 2). Here I recall upon these concepts in a similar order as in chapter 2, and link them to the findings in the case studies.

7.4.1. Technical and organizational complexity
Both the technical and the organizational complexity are perceived as extremely large. Some respondents even called these complexities as the main reason why so many IT implementations have failed or as the reason why knowledge management is not yet introduced. This is presented in line with the literature (section 2.1). In terms of technical complexity, the number of different applications and the old IT infrastructure were frequently mentioned. Organizational complexity
was seen within and between organizations. Within the organization was the distance between actors (section 7.3), the differences in way of working, the ‘not invented here syndrome, and the lack of insights in each others processes often mentioned. Especially in an organization using clinical pathways, coordination between professionals is required. Authors like Berg (2001) argued that professionals that cooperate and coordinate their processes are required for this way of organizing.

7.4.2. The professional bureaucracy and the importance of knowledge

As section 7.3 analysed, the theories of Mintzberg (1983) are generally acknowledged by the case studies. The differences in actor perspectives confirm his work. The autonomy of the professionals leads to bottom–up decision–making. This power is characterizes Mintzberg’s (1983) professional bureaucracy. Also Boonstra and Van Asch (1994) conclusions about the hospital as a professional bureaucracy are accepted: (1) the work processes are difficult to learn but well defined, (2) the environment is complex but stable, and (3) the technology is advanced but un-regulated.

Conform literature (section 2.2), the importance of knowledge is mentioned by the respondents. Some immediately relate this knowledge to patient information, typified as knowledge in the primary processes. Having the complete information and medical history of a patient available prevents making mistakes, makes the process more efficient and increases the quality of the decisions made. Berg (1997) identified the importance of knowledge in and about the primary process in the hospital. Some respondents brought up the importance of knowledge about the process to improve the processes. The respondents follow Berg’s (2001) conclusion that interactions between professionals defines the care processes, that consists of continuously (re)interpreting what the problem is and what needs to be done.

7.4.3. Knowledge management

The theories of Drucker (1988, 2001), Nonaka and Takeuchi (1995), and Weggeman (1997, 2000) and others, who see knowledge as an essential factor of production that needs to be managed, were generally unknown by the respondents. This was proved in chapter 2 (Wyatt, 2001), that concluded that knowledge management in health care was limited to the application of ‘evidence based’ knowledge by protocols, education and limited use of search engines on the internet. The difference between tacit and explicit knowledge, as well as the notion of knowledge management as defined in chapter 2, was difficult to understand. This made it hard to introduce socialization and externalization concepts (Nonaka and Takeuchi, 1995) of knowledge. Even though knowledge exists everywhere in the hospital and the characteristics of knowledge intensive organizations (Sadler and Milmer, 1991) were recognized, a few respondents understood how knowledge could be managed. The codification and personalization approaches have been explained, leading to a limited understanding of the possibilities of IT.

It follows from the case studies that those knowledge management concepts that follow from knowledge management authors only are known by some managers. No real implementations of these authors’ methods have been identified. However, once explained, the concepts and the potential benefit are recognized.

7.4.4. Co–operative setting

The co–operative setting, in which professionals are stimulated to share their knowledge (Weggeman, 1997) could not be verified in the case studies. None of the respondents disagreed with the idea, but in the case studies no knowledge management experiences have been found, that gave useful insights.
However, the different aspects of the knowledge environment (Van Oirschot, 2003) appeared to be relevant. Respondents mentioned the different aspects of the model often. Questions related to requirements, obstacles and experiences with IT were answered with answers that could be put in one of the four components of the knowledge environment. The interview reports have been structured using these components. When analysing the interviews in tables (see Appendix I) all relevant answers could be put in one of the four components.

The principles of trust and tacit mistrust in knowledge management and systems (Huotari and livonen, 2004) were as such mentioned by the respondents. For implementing new systems, a trust in the benefits of the systems by the end-users proved to be crucial. Too many failed implementations have led to a tacit mistrust under end-users for new systems. When a new system is introduced, the expectations are low.

7.4.5. IT classification
The classification of IT tools in codification and personalization (table 5, chapter 2) proved to be useful when explaining the role IT can play in knowledge management to respondents. The classification in these two groups was easier to understand than the classification in five groups (table 6, chapter 2), but there was no evidence that this classification would not hold. For many interviewed persons it was difficult to understand the classification of IT systems in these five categories. Only some respondents, with an IT background, could follow the classification and found it useful to indicate the roles of knowledge management.

This lack of insights in IT systems and their possibilities characterizes clinicians in the health care sector. Here we reach one of the main dilemmas of this research. To implement IT solutions in the primary process, knowledge of the primary process and IT solutions is needed. Clinicians with IT knowledge only exist incidentally.

7.4.6. Where is the limit?
Chapter 2 ended with a short notion of the extent to which IT systems could automate the hospitals. Not much literature was found on this subject. Berg (2001) mentioned that somewhere there would be a limit. Based upon this notion, the question was asked during the interviews. Only a few respondents were able to indicate how far the influence of IT might be able to go. They mentioned the complexity of the human body and the ethical perspective of decisions as two important limitations. The idea of fully trusting IT decision-making was clearly unsupported. The fact that many routine and some more advanced IT processes to a certain degree can be supported, was generally accepted.

7.5. Analysis of successes and failures
This section recalls upon the fifth sub question of this research:

| Question | To what extent can the requirements and obstacles explain successes and failures in experiences and how can this be linked to the theoretical problems? |

The literature and case studies revealed many possibilities for knowledge management and IT to improve the primary processes in the hospitals and increase the efficiency and quality of patient care. Interviews provided both requirements (as identified in chapter 4) for an ideal future hospital. However, the obstacles (chapter 5) are large and numerous. The interviews revealed only limited experiences (chapter 6) with knowledge management and IT solutions. The results
showed how many projects have failed, due to the obstacles mentioned in chapter 5. The requirements, obstacles and experiences that have been analysed in the first section of this chapter (7.1) lead us to the following main analysis.

**Answer** The obstacles to overcome in order to profit from knowledge management and IT in health care are large. The success of projects is usually small and the failures reveal the difficulties to implement the solutions offered. Based upon the results from literature and case studies, it is concluded that the high potential of managing tacit knowledge through IT systems cannot be reached in the current hospitals.

### 7.6. Towards a final conclusion

So far, I showed, using literature and case studies, that there is an urgency to improve the quality and efficiency in hospitals. Knowledge management and IT provide opportunities to increase these efficiency and quality. I explored the concept of knowledge in the hospital. Tacit knowledge turned out to be of utmost importance, but it is difficult to manage this intangible form of knowledge. Hospitals lack the experience to manage this knowledge effectively. Current IT systems offered by the IT staff provide solutions to information management, but these do not match the expectations of management, professionals and nurses. Many projects are rejected because they offer additional load instead of added value or are not implemented with awareness for the organizational needs.

Furthermore, before it is possible to implement IT solutions, processes need to be organized. There is a trend towards clinical pathways, which organize care processes in such a way that efficiency and quality can be improved. This way of organizing processes, provides extra possibilities for knowledge management and IT to increase efficiency and quality even more. However, the use of knowledge management and IT is still limited. This chapter has shown reasons for this, and concluded that the obstacles for implementations of solutions are too high. In the next chapter, the final research question is answered.
8. Conclusions and recommendations

In the previous chapters, all sub questions have been answered using literature and case studies. Following the answers to the sub questions, in this chapter I answer the main question of this research. This chapter covers four conclusions (sections 8.1 to 8.4). Each conclusion provides a recommendation for the hospitals to answer the main question:

| Question | How can hospitals manage tacit knowledge through IT systems? |

The question is based upon the assumptions that hospitals can manage tacit knowledge through IT systems to improve the efficiency and quality of the hospital. However, the analysis (chapter 7) revealed that there are such high obstacles for the implementation of tacit knowledge management and IT systems that it is hardly possible to manage tacit knowledge in practice through IT systems. My first conclusion is therefore: 'At this moment, hospitals should not manage tacit knowledge through IT systems'. Section 8.1 gives arguments and recommendations for this conclusion.

8.1. Conclusion 1: At this moment, do not manage tacit knowledge through IT systems

The introduction started with the notion that it seems impossible to manage tacit knowledge through IT systems. IT systems force knowledge to be made explicit and that is only possible in some circumstances. To elaborate further on this conclusion, I first consider the impossibilities in the nature of tacit knowledge and then I elaborate on the obstacles, experiences and perceptions in managing tacit knowledge through IT systems.

8.1.1. Nature of tacit knowledge in the hospital

Following the conclusion of the theoretical analysis in chapter 2, there are limited possibilities to manage tacit knowledge through IT systems. Intangible tacit knowledge can be made explicit only under special circumstances, and this is just one of the tensions between tacit knowledge and IT. Tacit knowledge develops when the clinicians become more experienced, but can also be learned in interaction and co-operation between people – for instance in a master-apprentice or collegial relationship.

Literature and interviews revealed how tacit knowledge in hospitals allows the professionals and nurses to deliver health care in situations where every patient is unique. Especially in complex situations where too many factors come into play to make decisions based upon explicit rules, the ability of the clinician to use tacit knowledge is needed. We have seen this happen in practice in the intensive care. Under high pressure, complex decisions that have large consequences need to be made. Tacit knowledge is therefore crucial in these circumstances.

This tacit knowledge is intangible and theoretically difficult to manage through IT systems. The proposed possibilities to manage tacit knowledge through IT systems each require special circumstances. For instance, videoconferencing would be an instrument to distribute the tacit knowledge behind a certain way of handling, but it still requires parts of this tacit knowledge to be somehow made explicit. In the fourth conclusion, I come back to this and other examples of managing tacit knowledge through IT systems.
8.1.2. Large obstacles and different actor perspectives

In chapter 5, obstacles for tacit knowledge management, IT systems and the combination of these two have been revealed. The knowledge environment within organizations, needed to provide the circumstances to allow this way of sharing tacit knowledge, is difficult to ‘create’. The barriers for using knowledge management (not yet implemented) and IT (many implementations failed) are large. Within the hospitals, there are only limited experiences of increasing the efficiency and quality of patient care by implementing knowledge management and IT solutions. The research has revealed reasons for this. The technical and organizational complexity in the hospital makes it difficult to implement new solutions. Literature and case studies revealed obstacles among all components of the knowledge environment. Some examples are:

- **Organization structure** Distances between actors and shifts in the organizational structure due to working among clinical pathways (requires more cooperation and coordination).
- **Competences** The lack of IT competence and competence to cooperate and coordinate work processes together with the traditional way of education.
- **Culture** Aspects like technology acceptances, tacit mistrust, hierarchical culture and the ‘not invented here’ syndrome.
- **Systems** Legacy infrastructure and technology, a tremendously large number of different independent applications and a lack of benefit in IT solutions.

One of the main obstacles is the tension between the different actors. Management, professionals and nurses each have different requirements for knowledge management. Each actor focuses on its own dilemmas. Managers see knowledge management as a tool to enhance organizational performance by reducing costs. At the same time, they face a dilemma between autonomy and freedom for the professionals or strong command and control. Professionals experience knowledge management as a possibility for individual learning; they are keen on their autonomous position. Nurses work more routine-like and have less insight in the extra possibilities of knowledge management. They often need concrete examples to appreciate the added value.

These different views together create a consistent view in which knowledge management and IT systems are needed, yet behind this view are different nuances in perspectives. Implementing knowledge management and IT systems requires:

- dealing with these different nuances and
- foreseeing clashes between the different actors.

The long list of barriers reveals that hospitals are not ready to implement tacit knowledge management through IT systems. In addition, for the implementation of tacit knowledge management and the implementation of IT systems many barriers still have to be lowered.

8.1.3. No experiences in practice

The obstacles make it difficult to manage this tacit knowledge in practice. Even though literature provided us with some principles of conditions under which tacit knowledge can be made explicit and managed, in practice no experiences in tacit knowledge management through IT systems in hospitals are found within literature and case studies. There are no current solutions for this available. Moreover, no plans in this direction have been found. The lack of experience and solutions in practice, and the lack of plans in this direction make it difficult to find arguments to develop tacit knowledge management through IT systems.
8.1.4. Perception of the possibilities is negative

Even though in the interviews respondents mentioned the importance of tacit knowledge and IT systems, for most respondents the possibilities for tacit knowledge management through IT systems seemed limited. Especially nurses could not come up with concrete possibilities for IT systems to be useful to tacit knowledge management. Despite some visionaries, there is a negative perception and respondents did not know how to manage tacit knowledge with IT systems. The functions of IT systems are currently limited to the distribution of information. Some steps still need to be taken towards a full operational EPR (Electronic Patient Record).

It is clear that hospitals are currently focussed on information management instead of knowledge management. To most respondents it turned out that information management need to be professionalized first, before considering knowledge management.

8.1.5. Recommendation

This conclusion is the first answer to the main question:

<table>
<thead>
<tr>
<th>Question</th>
<th>How can hospitals manage tacit knowledge through IT systems?</th>
</tr>
</thead>
</table>

The analysis revealed that there are too many obstacles to manage tacit knowledge through IT systems and showed a lack of experiences and ideas of how to handle these barriers, the recommendation here is negative:

<table>
<thead>
<tr>
<th>Recommendation (1)</th>
<th>At this moment, hospitals should not put effort in managing tacit knowledge through IT systems, because they are not ready to overcome the large obstacles.</th>
</tr>
</thead>
</table>

Be aware, I do not argue that hospitals should not manage tacit knowledge; I argue that for the moment IT systems should not be used for this. As I will conclude in the following two sections, tacit knowledge management and IT systems should be further developed separately.

8.2. Conclusion 2: Manage tacit knowledge differently

The perceived impossibilities for tacit knowledge to be managed through IT systems did not lead to the idea of ignoring the opportunities of managing tacit knowledge. It does lead to the conclusion that tacit knowledge should be managed differently – i.e. not through IT systems yet. The respondents agreed on the notion that tacit knowledge management could be beneficial to the quality and the efficiency of health care. This conclusion was also revealed from the literature study.

8.2.1. The importance of tacit knowledge management

Especially, in the situation where hospitals are subject to many changes and developments, tacit knowledge becomes more important than ever. We have seen numerous examples during literature and case study research. In situations where clinicians have to cooperate and coordinate their work processes internally, and in many cases, even with actors outside the hospital, the potential of tacit knowledge management becomes visible. The trend towards clinical pathways, for instance, requires that clinicians have insights in each other’s processes. The importance of both explicit and implicit knowledge increases fast. Developments in IT lead to systems that can exchange large amounts of information and explicit knowledge between clinicians. The tacit knowledge to be able to understand and process all this information is more important than ever and the question arises how this tacit knowledge can be managed.
The following four components of the conclusion are based upon the knowledge environment that has been central in this research. The balanced components of the knowledge environment together create the ideal situation to allow the exchange of (tacit) knowledge. The findings from this research that influence the possibilities for knowledge management are restructured here.

8.2.2. **Balance the knowledge environment: organizational structure**

For the exchange of tacit knowledge, the organizational structure is very important. Although clinicians have many informal contacts, the people they have the most interaction with are determined by the organization structure. The research showed many examples of situations where there was a lack of insights in the different working processes of the clinicians. For instance at the MCRZ, nurses have been put in interdisciplinary workgroups to gain insights in the differences in working methods between different departments. A very successful way to create quality-awareness is discussing the working methods and the reasons behind them. Talking about quality and defining protocols together require some tacit knowledge to be made explicit.

**From teamwork to the building of a network**

At the LUMC, the department of dieticians launched a community website to support the building of a community of dieticians within and outside hospitals around the LUMC. By getting to know each other and the possibilities to find telephone numbers and e-mail addresses on the community site, the barriers to get in contact are lowered. A new transmural way of working requires cooperation and coordination of work processes. Furthermore, knowledge needs to be exchanged. By bringing dieticians into contact with each other, it is possible to exchange (tacit) knowledge among the network. The experiences found in the case studies where limited. The community site just started. The initiators of the network still had many question relating the use of the website and the possibilities for knowledge exchange through the community website. The potential seemed clear, but the results of the network were limited to the notion that once people knew each other it was easier to pick up the phone.

In the theoretical problem exploration (chapter 2), I shortly covered the communities of practice, in which professionals can theoretically share tacit knowledge. Research pays much attention to this form of a network with tight connections, however, limited examples in health care are known. This research proved the potential for tacit knowledge management and these communities can form an important method in reaching this. One of the recommendations is to research further the possibilities for tacit knowledge management inside the hospital.

**Tacit knowledge outside the hospital**

Professionals are often highly specialized and a few have similar knowledge. Often they maintain contact with similar professionals in other hospitals, even around the world, to increase their knowledge levels and stay up-to-date about new developments. The interviews revealed how professionals share knowledge among these global networks. This allowed them to specialize more and in that way develop tacit knowledge. Only limited attention is paid to this type of knowledge sharing, which is the origin of a large part of the knowledge from the professionals. Hospitals could think about ways to facilitate and stimulate these forms of knowledge exchange.

8.2.3. **Balance the knowledge environment: competences**

An employee gaining new tacit knowledge can develop new competences. The organizational structure is largely influenced by the competence of the employees. The MCRZ has set the goal to become a teaching hospital, meaning that attention is paid to educational programs. Hospitals realize the importance of competences of the employees and pay more attention to training.
Employees are motivated to follow trainings and further develop themselves. The focus from hospitals on competences is in line with the life long learning trend in other sectors. Hospitals realize that it is more beneficial to have employees that are able to learn, than to have employees that know a lot. In addition, this leads to selection criteria for the recruitment of new personnel.

**Competence management**

I have already identified trends as clinical pathways that require new types of knowledge. Hospitals start to realize this importance of knowledge. However, active competence management is nowhere in place. Managers in the interviews found it difficult to make competences visible. Having insights in the competences of the employees allows for efficient use of these competences. This type of competence management is not in place in hospitals, but can form an important component of tacit knowledge management. Methods like job rotation allow employees to require new insights, competences and thus knowledge in other processes. At the same time, job rotations proved useful to tighten the gabs between different departments. In the MCRZ, IT professionals were regularly shifted to the other location to increase the cooperation and tighten the differences between the two locations.

**Standardization**

Another measure to increase the quality and efficiency by working on competence is standardization. The research showed examples of standardization in the IT departments, project teams and among nurses. In the IT department of LUMC the infrastructure components were standardized, while at the same time an IT reference architecture was used to reduce the variety of IT terms. At the MCRZ, a pool of project consultants was maintained internally. When projects were executed, they could share the experiences. Currently, in many hospitals standardized project languages, like PRINCE2, are taught to allow project teams to share knowledge more efficiently.

Nurses at the MCRZ defined protocols together, to start working more standardized. Standardization leads to more quality and efficiency. To define the protocols tacit knowledge about the reasons beyond a certain way of working had to be discussed. Explaining how processes were executed revealed differences in the way of working between departments. Together designing new protocols increased the quality and efficiency of the work done, while at the same time, the nurses gained more insights, competences and knowledge in their work processes.

**Tacit knowledge is managed individually**

Trainings, job rotations and standardization proved effective measures to stimulate the exchange of tacit knowledge at the collective level. In addition, hospitals can think about ways to stimulate the exchange of tacit knowledge at the individual level. We have seen how professionals tend to share their knowledge in networks. Their professionalism requires continuously staying up-to-date and exchanging knowledge. How can hospitals stimulate knowledge exchange at the individual level? Since no practices for this type of knowledge management have been found, it forms a subject for further research. Perhaps the measures to stimulate knowledge exchange are dependent on the type of knowledge, which differs for different professionalisms. This research indicated the potential to implement incentives to stimulate tacit knowledge exchange at the individual level and recommends further implementing such incentives. However, the concrete incentives are subject for further research.

**8.2.4. Balance the knowledge environment: culture**

In addition, cultural aspects determine the possibilities for the exchange of tacit knowledge. In a very hierarchal culture, with large distances between clinicians and autonomous working
professionals it is difficult to share knowledge. Respondents saw the importance of the cultural aspects for the exchange of knowledge, but mentioned in addition the difficulties to change the intangible culture.

At the LUMC, management tried to stimulate a learning culture. Mistakes are tolerated as long as there is learning effect. Employees are stimulated to solve problems immediately. When needed, the help of colleagues can be asked. A certain attention to culture was also found at the MCRZ, where nurses were motivated to work with a patient-central attitude. Having an eye for quality is considered as an important aspect of culture, which is difficult to achieve due to the culture determined by working routinely.

The creation of an open culture in which the exchange of knowledge is stimulated with incentives is an important requirement for the balanced knowledge environment in which tacit knowledge can be shared. As holds with the other components of the knowledge environment, it is not the culture alone creating this environment; it is the balance between all the four components. Therefore, also the use of systems to stimulate tacit knowledge exchange need be considered.

8.2.5. Balance the knowledge environment: systems

We come close to the central question in this research managing tacit knowledge through IT systems, when we use IT tools to support the communication between professionals in order to share tacit knowledge. However, also non–IT systems can be beneficial to stimulate the exchange of tacit knowledge.

Soft systems

Systems that give incentives to employees to share tacit knowledge are unknown in health care. Such systems could for instance reward knowledge sharing initiatives. Possible incentives are salary, trainings, or other returns that stimulate certain employees to share knowledge. Here counts as well that these systems alone would not lead to the right results. Measurements should be aligned with organizational goals, work processes and the other components of the knowledge environment.

Other systems can be systems that manage or give insights in competences and in that way motivate somehow. Such systems do not exist in the hospitals yet and further research of such systems could be beneficial.

Support communication with IT systems

IT systems can support the communication within the hospital in many ways. Hospitals equip their professionals with mobile phones and provide clinicians with e-mail addresses to facilitate the communication between them. Being able to reach each other quickly proved to be important for the exchange of tacit knowledge.

The research showed the need for even more direct communication, because e-mail is too slow and mobile phones are often unavaiable. Forms of instant messaging of the availability of other persons can in addition be beneficial to support communication. Advanced possibilities to communicate allow sharing tacit knowledge. Modern IT applications can store conversations and are able to search through them.

Next to the support of rich communication between professionals, IT can also support building a network. This includes searching for people with certain knowledge and maintaining contacts.
The literature research and the experiences in practice revealed already many examples of communication and networking software.

8.2.6. **Further research the possibilities of tacit knowledge management**

Above, I already stated the potential to research further the possibilities of tacit knowledge management. I used the knowledge environment to structure some example measures. On all components, I identified possibilities manage tacit knowledge. However, all components need further research. The limited experiences of stimulating the exchange of tacit knowledge in the hospitals are insufficient to determine the real success.

At the same time, many of the obstacles mentioned in chapter 5 still hold. The complexities make it difficult to implement measures for tacit knowledge management. The large differences between actors and even the differences between for instance different professionals require further research in the possibilities of tacit knowledge management. Do these actors and different professionals need different approaches? This research did not consider the differences between professionals but tried to give a more general overview taking the differences between actors into account.

8.2.7. **Recommendation**

Tacit knowledge is extremely important for increasing the quality and efficiency of the processes in the hospital. Managing tacit knowledge can therefore be very beneficial. Even though we concluded in conclusion 1 that ‘hospitals should not manage tacit knowledge through IT systems’, I conclude in my second conclusion that ‘hospitals should manage tacit knowledge differently’. The recommendation that is given based upon this conclusion is:

**Recommendation (2)** Hospitals should consider the possibilities to implement tacit knowledge management, since there is a large potential. Different measures to stimulate the exchange of tacit knowledge have been revealed, using the four components of the knowledge environment. There is however limited experiences with these measures. For different professionalisms for instance, different measures might apply. Further research should gain more insights in the possibilities to manage tacit knowledge.

8.3. **Conclusion 3: Use IT systems differently**

No doubt, IT has a huge potential to increase the efficiency and the quality of the health care processes in the hospital. IT is already marching its way into the hospital, but has a lot more to offer. In chapter 2, I covered the spectrum from information and explicit knowledge to tacit knowledge. Despite the question if hospitals should manage their tacit knowledge with IT systems, they can start with solutions to manage information and explicit knowledge. These solutions can largely benefit to quality and efficiency in the hospital. In this way, they lower the barriers for tacit knowledge management through IT systems in the future.

8.3.1. **Organization before automation**

Practices in both hospitals and in the literature study showed the importance of organizing health care processes before automating them. Moreover, in other sectors the ‘organization before automation’ is generally accepted after years of experiences with IT implementations. In hospitals, we have seen the trend towards clinical pathways. Health care processes are organized in such a way that the patient flows like an entity through the system. This way of organizing allows a more efficient organization of processes. The patient is being treated by more professionals; each sub specialized in special actions. This requires professionals to cooperate and
coordinate their work processes. In addition, it requires professionals to obtain competence to manage these processes. This can become complex when the clinical path involves processes in other departments or even other organizations.

The transition towards clinical pathways might be difficult for hospitals. However, reorganizing the processes is the best way to improve the quality and efficiency of health care. In reorganizing the processes, it is important to consider the knowledge required to execute the processes.

- **Tacit knowledge** Only experienced professionals can do certain processes.
- **Explicit knowledge** For instance protocols, which define the way of working.
- **Information** Patient dependent information, such as the medical history.

### 8.3.2. Automating the clinical pathways

Parallel to organizing the primary processes by designing clinical pathways, IT solutions should be designed to support these clinical pathways. The research revealed that the potential of IT to support the primary processes is large. However, current solutions lead to dissatisfaction, because the systems do not offer enough benefits. Based upon the analysis in the previous chapter, I argue that there are many possibilities to enhance the quality and the efficiency of the primary processes with IT. This requires that the design of clinical pathways goes hand in hand with the design of IT solutions that offer real benefit to the care processes. By parallels designing the two, the clinical pathway can be optimally supported by the possibilities of IT systems.

A clear example can be found in Germany. The Knappschaftskrankenhaus in Bottrop has developed clinical pathways for most processes in the hospital. The organization of the clinical processes is totally embedded in IT systems. Doctors that walk around with tabloid pc's can have real-time information about the patients and the processes. Professionals become 'managers' of the clinical pathways, they can continuously monitor the status of the patient because real-time information is available. The results are enlightening: more efficiency and higher quality of health care. Management, doctors, nurses and patients are very satisfied with the system.

Once the processes have been organized efficiently, the real benefits of IT can be used to significantly increase the efficiency of the clinical pathways. The classification made in chapter 2 helps to clarify that IT both can support the codification strategies (delivering explicit knowledge and patient information through information systems) and personalization strategies (exchange of tacit knowledge through communication systems). Both strategies are needed to embed the clinical pathways in IT systems and optimally use IT to support the processes. This requires a new competence of the professionals, managing the clinical pathways.

### 8.3.3. Further possibilities for IT

The role for IT systems can be extended further:

- The Electronic Patient Record (EPR) provides the professionals and the nurses with the right information about the patient. Especially the availability of the medical history of a patient is crucial to prevent complications in treatments or prescribed medicines. Furthermore, an EPR leads to standardisation in the way of working and a reduction of mistakes. Most hospitals have a local EPR for medical information in place. There are also some pilots with adding for instance information for nurses to the records. The national challenge is to link these EPR's together, in such a way that patient records can be send to other hospitals. The required openness of information leads to questions about privacy. Privacy, technology and organizational issues prevent the creation of a national EPR.
- IT systems can support the communication between different actors in the primary processes. Both a-synchronous (like e-mail and messaging) and synchronous communication...
(for instance telephone and videoconferencing) can be made more efficient (less time needed to contact each other, for instance because the availability of the other person is visible) and effective (conversations can be saved, so the same questions do not need to be asked repeatedly). During the research, we have seen for instance Altrix as a tool for communication amongst nurses. It has been used very well and is real solution for the communication problems.

- The research showed examples of how a network of professionals could be supported with a community website. Different forms of ‘networking software’ (see classification in chapter 2), allow professionals to stay in contact and enable communication between professionals.
- IT can support the decision–making processes, when decision trees are embedded in applications. Although the final decisions will always be made with tacit knowledge, IT systems can facilitate medical decisions making. This allows medical treatments to be done more efficiently and allows for contact that is more personal. In chapter 4, the example is found of a professional who finds certain complications that can lead to more diagnoses. This professional can get the advice to run certain tests to make sure the right diagnose can be concluded. Of course, professionals have learned how to make these decisions, but often they can be supported by IT systems to reach the conclusions faster. Professionals indicated in the interview the importance of their central position in automated decision–making.
- Monitoring of clinical pathways allows signalizing patients who get unexpected complications. Once certain complications occur that differ from expectation in the medication, the monitoring system can warn the professionals about patients who drop out of the system.
- Management information and statistics can be gathered to get real–time information about the population of patients. The automated decision–making can be based upon these real-time statistics.
- IT systems can be used to provide information to the patient. Current information is often general and not adjusted to the unique situation of the patient. IT systems allow information to be delivered in such a way that it fits the situation of the patient.

Dependent upon the efficiency gained and the costs a decision should be made to implement one or more of these functions for IT. Some functions require other functions to be implemented first.

**8.3.4. Design together with the end–users**

The research showed the importance that IT solutions should be designed in agreement with the end–users. These end–users are in the hospital both the professionals and the nurses, who have to work with the system. Their tacit knowledge and explicit knowledge are intertwined. The tacit knowledge is intangible but (as we saw in chapter 2) can be used under the right circumstances. When clinical paths and IT solutions are designed together with the end–users, their tacit knowledge is used to optimally enhance the efficiency and the quality of the processes.

We have seen in the research in both hospitals that once professionals and nurses are forced to participate in the innovation processes they are obliged to:

- Make their tacit knowledge about the processes explicit;
- Reflect on possible improvements;
- Improve the processes;
- Create systems that have real added value (deliver the right information at the right time).

Alongside the specific knowledge that professionals and nurses bring into the design, their involvement has other advantages. According to the research (chapter 5) an important obstacle in hospitals is the ‘not invented here syndrome’. Many solutions that have been successful in other
Conclusions and recommendations

hospitals have been rejected because of their origin. When professionals and nurses take part in the design process, the idea is more likely to be accepted by the organization and perceived as invented within the group.

Another significant benefit of involving end–users in the design, is that it reduces the tacit mistrust towards innovations (chapter 2, Huotari and livonen, 2004), a significant obstacle in hospitals. Many failures have lead to a lack of trust in new ideas, but once nurses and professionals from the own organization participate significantly in the design, trust arises. End–users assure that the solution has real added value. During the design process, it is necessary to exemplify the added value. The research showed the important of a leading person to establish enthusiasm and exemplify the benefits among the end–users. This person preferably comes from within the group of the end–users and represents their requests.

Finally, the end–users can improve the usability of the system. It proved to be crucial that systems suit the way of working. A bottom–up design that starts with the expectations of the end–users ensures that the system is user–friendly. It followed from chapter 6 that experiences with bottom–up designed applications are very successful. These simple adjustments can deliver large benefits. Exactly those simple solutions, introduced by the professionals themselves, seem to be the most successful ones. The main dilemma here is that IT people have the skills to see IT possibilities, where clinicians can see the possibilities for improvements in the processes. People that have both IT and medical competences are needed, and these people are scarce.

This approach for involving end–users is not very new; Boehm (1988) developed his spiral model for software engineering based upon on the same assumptions. Boehm designed a software development process where each cycle produces something to be evaluated, but not necessarily something usable. Evaluation cycles with users would lead to better accepted systems than the traditional way of software engineering (i.e. the waterfall model)

Once the solution is designed, it can be realized by IT professionals. The result is an improvement of quality and efficiency by supportive IT systems. Another significant benefit of well–designed information systems is reducing the extra administrative load. Through well–designed information systems, it is possible to change and influence the working methods of the professionals. The adjustments can be imposed invisibly and are not the old–fashioned bureaucratic changes.

8.3.5. Further research the possibilities of IT

Rapid developments in the IT (new technology) world and in the health care (reorganizations and clinical pathways) create new possibilities for IT. Continuously researching these possibilities allows making use of the possible benefits from these systems.

At the same time, research needs to be done to the implementation of the systems. We saw that many system implementations failed because of a lack of insights in the end–users. Where does this low technology acceptance come from? The consideration of the organizational needs when designing information systems can be subject of further research.

While IT marches its ways into the hospital, further research can shine a light on the limit of IT use in the hospital. In chapter 2, I raised the question how far the automation will go. IT has the potential to take over many activities of the clinicians; but can IT take over all the primary processes in the hospital? When processes become too complex to be embedded in predefined
models, the possibilities of automating are limited. Moreover, there are ethical decisions to be made, causing humans to be irreplaceable.

This research indicated that it is important that professionals realize that IT is not replacing them, but instead supporting them. IT can for instance take away administrative ballast and execute extra checks to prevent mistakes. Professionals can use the extra time to increase the quality of the care taken and for instance spend more time on personal coaching of patients. Again, this would be an interesting starting point for further research to improve the quality and efficiency in the hospital.

Finally, the business case for IT developments is difficult to make. Costs come soon and are high, while profits are invisible. The example of the PACS implementation at the MCRZ revealed how one department is profiting from the benefits of the systems, while others perceive a less optimal situation. The influence of IT application is often large and cannot completely be overseen. When a professional saves time determining the medication of a patient, the extra time is not used to see more patients, but to extra medication for this patient or for instance personal coaching. Because the added value disappears, it is difficult to calculate the business case for IT developments. Managers decide upon these business cases, but often the results of a project do not confirm the business case.

8.3.6. Recommendation

There is a huge potential in IT systems to gain efficiency and quality in the hospital. In this research, I reveal numerous applications where IT can be highly beneficial. However, there are very large obstacles to IT implementations, from both an organizational and a technical point of view. The conclusion that ‘hospitals should use IT systems differently’ lead to the recommendation:

**Recommendation (3)** Implement IT systems carefully, with an eye for organizational processes. Be aware of and keep exploring the possibilities of IT systems. There is a huge potential in them, but take care of the obstacles. Experiences revealed how successful ideas have become failures when the implementation does not consider the end-users. Therefore, the end-users need to be involved in the process. Only then can IT systems increase efficiency and quality in the hospital.

8.4. Conclusion 4: Manage tacit knowledge through IT systems in the future

Conclusion 1 tells that at this moment the combination of tacit knowledge management and IT is difficult. Conclusion 2 and 3 recommended paying attention to both tacit knowledge and IT systems in the hospital separately. Does this mean we should abandon the ideas of tacit knowledge management in combination with IT systems completely? Perhaps that would be too easy. The conclusion that hospitals should not put effort in this way of managing knowledge is based upon high obstacles and no experiences. The research indicated a potential for tacit knowledge management through IT systems that might be reached in a future with lower barriers and experiences in this subject. In this section, I give more arguments for this.

The conclusions 2 and 3, to manage tacit knowledge and use IT systems separately, build up to this fourth conclusion. By starting with these two recommendations separately, the barriers are lowered for managing tacit knowledge through IT systems in the future. At the same time, experiences lead to more insights in the possibilities and there is more time for new research (see research recommendations).
8.4.1. The potential of managing tacit knowledge with IT

In chapter 2, I presented a framework that showed possibilities of IT to manage a spectrum from explicit to tacit knowledge. Software that supports interactions between people can be used in some cases to support the exchange of tacit knowledge. Direct communication tools, embedded in networking software, can facilitate tacit knowledge management. The idea that all tacit knowledge should be made explicit is abandoned.

In the hospital situation, this can be visualized when two professionals communicate with each other using for instance video conferencing. Looking each other in the eye, being able to show behaviour and gestures allows the exchange of patient information, explicit knowledge and tacit knowledge at the same time. For efficient management of all these types of knowledge, a more advanced IT infrastructure is required. In the case of video conferencing, it can be beneficial to save the conference and be able to store it. Searching with keywords through the database of previous answered questions can quickly give access to those who have the same question.63

In addition, there is also a strong need for tacit knowledge management, despite the fact that respondents did not see concrete possibilities to implement it. Respondents came up with numerous situations in which the tacit knowledge of for instance a highly specialized professional is needed. Professionals are very scarce and often unavailable at certain moments. The lack of redundancy of professionals creates a need to have their tacit knowledge available anytime and anywhere.

The trend towards clinical pathways requires new competences from professionals and nurses. Instead of working highly specialized they have cooperate and coordinate their work processes. The competences are needed to oversee the consequences of their work, and to coordinate the work processes with others. Some say the clinicians become managers of the clinical pathways. This way of working requires in addition insights in the tacit knowledge from others and all types of knowledge to be shared efficiently. The potential to use IT here for the management of tacit knowledge is clear.

8.4.2. Lowering the obstacles

The obstacles mentioned in this research are significant and will, to some extent hold strongly in the future. It is important to consider them and find possibilities to lower these barriers. Managing tacit knowledge and implementing IT systems separately is a good way to achieve more insights in the obstacles and their origins.

Apart from all the obstacles, this research showed that there are still possibilities to streamline the implementation of new IT and knowledge management solutions. When there is a sense of urgency, strong added value for the end-users, a leading person, and enough end-user involvement new solutions can expect sufficient support. Section 8.4.4 goes deeper into the possibilities of implementation with a process recommendation.

8.4.3. Speed of developments

Developments in IT go fast. New application and systems become available all the time. International competition in the IT market also decreases the prices for IT solutions. Experiences with IT systems in the health care and other sectors lead to new insights. Arguments beyond the conclusion that current IT systems are insufficient to manage tacit knowledge through IT might in a few years no longer hold.
In a similar manner, the hospital world is under rapid changes. The influences of new IT systems and organizational changes are large. Implementation of tacit knowledge management (conclusion 2) and new IT systems (conclusion 3) will lead to insights how to lower the barriers. Some barriers will disappear because of the changes.

Even if there is quite some difference between hospitals, I argue that, based upon my research findings, in two to three years reconsideration is needed of the possibilities to manage tacit knowledge through IT systems. Some hospitals, for instance the academic hospitals, will need only two years. Others might need a little longer. Nevertheless, within five years most of the hospitals in The Netherlands will have undergone such significant changes that I foresee the use of ‘tacit knowledge management IT systems’.

8.4.4. Research the possibilities for implementing tacit knowledge management through IT systems

Conclusions 2 and 3, concerning the separate implementation of tacit knowledge management and IT systems, were joined with the recommendation to research the possibilities of successful tacit knowledge management and IT system implementations. Aligned with these two options for research I recommend researching the possibilities for implementing tacit knowledge management through IT systems within two to three years. Once hospitals start researching these possibilities now, they can reconsider the implementation in two to three years.

Based upon this research, I developed an approach to implement improvements in the primary processes that use both IT systems and tacit knowledge. I used a process design, in which the sense or urgency is central. Such a sense of urgency, during the whole process, is often difficult to achieve but is essential the process approach. The process design can be used as a starting point for further research into tacit knowledge management through IT systems.

Process approach

Given the obstacles in chapter 5, it is difficult to introduce new solutions in hospitals. The current project management approach in hospitals is filled with complications. Reasons that project management fail are among others:

- Various actors need to cooperate, that have different perspectives and objectives.
- The impact of redesigning primary processes in the hospital is very large, and not all consequences can be overseen.
- The possibilities for management to steer hierarchically professionals are limited. We have seen how professionals work autonomous at a large distance from management.

De Bruijn, Ten Heuvelhof and In ‘t Veld (2002) introduced a process approach, which is useful in such a setting. The authors describe how a process design can lead to results in situations where traditional project management is difficult. A process design should take care of four core elements (figure 14).
Conclusions and recommendations

Figure 14: Core elements of process design (De Bruijn, Ten Heuvelhof and In ’t Veld, 2002)\textsuperscript{65}

For this process design, the core elements would imply:

- **Openness** Keep the process open, so new actors can join in. Innovative mindsets are required and everybody with ideas for improvements should be able to join. There is a danger in creating a closed process, since it might lead to unaccepted results by the end–users. The dilemma occurs with speed when too many actors slow down the process.

- **Protection of core values** Especially the end–users in the process have core values, such as their own role in the solution. Professionals want to maintain a leading role to ensure the quality of treatments. Managers prefer to keep the solution manageable. It is important to realize and protect these core values; otherwise, some actors might block the process.

- **Speed** Maintain speed in the process, even though this can lead to dilemmas with the other three core elements. At some point, it is better to start working with a suboptimal solution, than to endlessly continue a discussion of better solutions.

- **Substance** This core value ensures the creation of real added value to the chosen solution. Paying too much attention to the other core values might lead to ‘negotiated nonsense’ solutions that do not meet the objectives of the process: increasing efficiency and quality.

In such a process, hierarchical steering plays an important role. Even though, for management the possibilities for steering among a traditional command and control way are limited, De Bruijn and Ten Heuvelhof (1999) show that in combination with its opposite pole ‘cooperation’, it can be quite effective. Top–down enforcements can go jointly with room for cooperation, or for example work as stimulation for cooperation. Given the situation in the hospital, where hierarchical management leads to resistance, it can therefore still be an effective method, when used in the appropriated way.\textsuperscript{66}

Based upon the above process design assumptions, the analysis of this research and the four recommendations, a process design is made consisting of twelve steps. This process design can be found in Appendix II. I consider the most important step of this approach, the sense of urgency, in more details.

*Create a commonly accepted urgency*

The research indicated the importance of urgency to be able to implement new solutions. The urgency to innovate is generally heard in health care, where the efficiency and quality are currently not as high as expected from a rich country like The Netherlands (see chapter 2). Hospitals are forced to deliver key performance indicators and increasingly compete with each other. This new form of competition does not directly lead to new hospitals, but a redistribution of patients is expected. In addition, hospitals have to cooperate increasingly with other organizations. Part of this is regulated by the Dutch government. This creates a commonly accepted urgency among all actors and requires processes to be redefined. It is important to make all actors aware of this urgency. Insight in the possible threats, but also examples of how other hospitals deal with problems, can create higher awareness.
The current way of improving the quality and the efficiency of health care proved to be unsuccessful. More rules lead to more bureaucracy. In the technical and organizational complexity of the hospital, it is very difficult to identify possible improvements. Professionals are already complaining about too many rules and bureaucracy and are unwilling to accept more changes and overhead in their way of working. I argue that if hospitals keep on trying to improve the complex technologies and organization of the hospital with more rules and bureaucracy, they will not reach real improvements.

Therefore, in this research, I used a new approach: looking at the primary processes and the required knowledge to execute these processes. The knowledge required is to a large part intangible and exists in the brains of the clinicians. Together with the explicit knowledge, it defines the way of working in the primary processes. It is hard to manage this tacit knowledge in an effective way; however, it provides new possibilities to look at improvements of the primary processes.

8.4.5. Recommendations

Before coming to the fourth recommendation, I list the previous recommendations.

**Recommendation (1)** At this moment, hospitals should not put effort in managing tacit knowledge through IT systems, because they are not ready to overcome the large obstacles.

**Recommendation (2)** Hospitals should consider the possibilities to implement tacit knowledge management, since there is a large potential. Different measures to stimulate the exchange of tacit knowledge have been revealed, using the four components of the knowledge environment. There is however limited experiences with these measures. For different professionalisms for instance, different measures might apply. Further research should gain more insights in the possibilities to manage tacit knowledge.

**Recommendation (3)** Implement IT systems carefully, with an eye for organizational processes. Be aware of and keep exploring the possibilities of IT systems. There is a huge potential in them, but take care of the obstacles. Experiences revealed how successful ideas have become failures when the implementation does not consider the end-users. Therefore, the end-users need to be involved in the process. Only then can IT systems increase efficiency and quality in the hospital.

Even though in the current situation barriers are too high to implement tacit knowledge management through IT, it is worth reconsidering it in two to three years. Recommendation 1 has been negative, but the potential persisted.

**Recommendation (4)** Start with lowering the barriers for IT implementations and tacit knowledge management solutions separately, to allow a reconsideration of tacit knowledge management through IT systems in the future. In the mean time, research the possibilities further. Once hospitals made significant improvements in the use of IT and tacit knowledge management and experiences are available, tacit knowledge management through IT systems will be reachable. New research should be conducted now, so that we can start the implementation of tacit knowledge management through IT systems in two to three years. The presented process design can be a starting point for further research.
Conclusions and recommendations
9. **Reflection and further research**

The relation between the literature study (chapter 2) and the case studies (chapter 4 to 6) has been analysed in chapter 7. Based upon the analysis, I concluded that obstacles in the hospitals are currently too high to really profit from the potential of tacit knowledge management through IT systems. The recommendation was given to improve tacit knowledge management and the use of IT systems separately and reconsider the possibilities for tacit knowledge management through IT systems in two to three years. This chapter reflects upon the research (9.1) and gives recommendations for further research (9.2).

9.1. **Reflection on the research**

The reflection upon the research is split into a reflection upon the demarcation (9.1.1), the research method (9.1.2), and the conclusions (9.1.3). Furthermore, I reflect upon the knowledge environment model that is used in this research (9.1.4) and on the usability of this research (9.1.5).

9.1.1. **The demarcation**

Quite some literature has been consulted for this research. A large number of sources were used to gather requirements, obstacles and experiences in using knowledge management and IT in other sectors than health care. The sources that cover health care were limited. Especially literature about experiences abroad could have lead to interesting examples. As stated earlier, the United States and Germany are often mentioned as good examples for IT implementations.

A few demarcations have been made, that might have influenced the results of the case studies slightly.

- The focus on tacit knowledge created an interesting starting point. Improvements in health care have been researched numerous times, though the influence of the human mind on the primary processes is (especially in health care) not yet linked to recommendations.
- To analyse this knowledge environment further the model of Van Oirschot (2003) that consists of four aspects: organizational structure, competences, culture and systems, has been used. To simplify the model, the outside world is somewhat neglected and for the system component only IT systems are considered. The choice of this model created a focus through which other aspects might have been neglected. In practice, since the four aspects are very broad, I do not believe that relevant aspects have been ignored. The outside world and the other systems would have had a small influence on the results.
- In addition, the model is extended with the three actor perspectives that make a successful implementation of knowledge management even more difficult, because each actor focuses on its own dilemmas. Managers see knowledge management as a tool to enhance organizational performance by reducing costs. At the same time, they focus a dilemma between autonomy and freedom for the professionals or strong command and control. Professionals experience knowledge management as a possibility for individual learning; however, they are keen on their autonomous position. Nurses have more routine-work and have little insight in the possibilities of knowledge management. They often need concrete examples to appreciate the added value.
9.1.2. Research method

There are a few weaknesses in the research:

- **Selection of two hospitals** One academic hospital (LUMC) and one general hospital (MCRZ) were chosen for this research. The conclusions are formulated as if they hold for any hospital in The Netherlands. The questions rise how representative these hospitals are for all hospitals and if academic hospitals and general hospitals are comparable at all.

- **Case study selection within the hospitals** The case studies in each hospital have been chosen based upon a list of possible case studies provided by the contact person in each hospital. Because the selection of case studies took place after the selection of the hospitals, relevant cases in other hospitals might have been missed. Both contact persons had a good overview of the projects in the hospitals, but relevant cases might still have been overlooked. The criteria upon which the cases have been selected can be found in chapter 3.

- **Selection of respondents** Using the contact persons in both hospitals, a list of people has been made that were involved in the cases and could represent the three actor perspectives: managers, professionals and nurses. Based upon the information given in the interviews other respondents have been selected. The limited number of respondents (11 in MCRZ, 12 in LUMC) did not allow for statistically significant conclusions.

- **Interview method** The interviews were very open, because of their explorative character. Respondents could to a large extent influence the substance of the interview. This lead to interesting interview reports that revealed many relevant aspects, but slight differences in the covered subjects. The interview reports have been verified with the respondents.

- **Deriving conclusions** Based upon the interview reports an investigation of requirements, obstacles and experiences was made for the three actors and the four components of the knowledge environment. The decision of which statements would lead to the conclusion was only partly made on a quantitative basis. Frequently heard arguments have been considered more important during the qualitative derivation of conclusions. Even though the conclusions followed from the statements in the interviews that were linked to the literature, selecting the conclusions has been a subjective activity.

- **Verifying conclusions** In both hospitals the conclusions have been presented to the contact persons. They verified the usefulness of these conclusions and added extra arguments for this way of working. In case more time would have been available, the conclusions could have been verified with more respondents.

9.1.3. Reflection on conclusions

The recommendation consists of four conclusions

1. At this moment, do not manage tacit knowledge through IT systems.
2. Manage tacit knowledge differently.
3. Use IT systems differently.
4. Manage tacit knowledge through IT systems in the future.

Since these conclusions follow the line of reasoning in this research (there is a potential, there are large obstacles and no experiences, developments in the near future lower the barriers) and the respondents did agree with the conclusions and the logic behind them, I assume they are grounded very well.

The only discussable part is the approach that, as a future scenario is proposed. The approach requires the involvement of actors in the hospital, while the research showed how professionals in the hospital can be resistant towards innovations as a serious barrier. However, the research also showed that actors in the hospital are aware that improvements are needed and that IT can provide possibilities. The problem lies in the fact that existing solutions are insufficient. I argue
that professionals can be motivated to participate in new solutions, once they get insights in the expected benefits. The challenge of the future is therefore to motivate these professionals. Elements in the suggested approach, like involving end-users and other actors in the hospitals should create commitment for new solutions.

The approach is given that is based upon the process approach of De Bruijn, Ten Heuvelhof and In ‘t Veld (2002) and ties together the experiences of projects in- and outside health care with implementing knowledge management and IT. The approach is therefore not totally new, but consists of proven concepts. Many obstacles, like the technical complexity, have not been tackled in the proposed approach, but this is why process management is chosen. Important weaknesses in the approach can be found in the literature for process management. De Bruijn, Ten Heuvelhof and In ‘t Veld (2002) mention two weaknesses in a process approach:

- The risk of process management within classical management styles
- The risk of ‘the swing of the pendulum’ in each process spectrum

9.1.4. Reflection on the knowledge environment model

The model borrowed from Van Oirschot (2003) proved to be useful. Even in the recommendation to manage tacit knowledge, the four components can be observed. The aspects are clear and form clearly relevant aspects for the knowledge environment. In chapter 2, I defined knowledge using the formula of Weggeman (1997).

\[ Knowledge = Information \times Experience, Skills, Attitudes (K=I^*ESA) \]

In this formula, the four aspects of the knowledge environment can be found. Information stands for the information systems (IT) that deliver the needed information. Experience is embedded in the professionals and in the organization. Skills are the competences needed. Finally, attitude is the culture in the organization. According to Weggeman (1997), these aspects define knowledge; according to Van Oirschot, these elements create the knowledge environment. Both authors find the coherence and the balance between the four points extremely important.

Moreover, the knowledge environment model is comparable to many organizational models: for instance the 7S model from McKinsey, or the ecology model of Davenport (six components).

9.1.5. Usability of the research

The research has been conducted for Aalera. The results are part of the consulting projects that Aalera conducts in organizations within and outside the health care sector. The conclusions and recommendations are useful in different projects and can lead to new successes in hospitals.

For hospitals, this research can provide insights in how to manage tacit knowledge and how to use IT systems. Some concepts might be directly applicable; others form incentives to look at future developments, as is the case when tacit knowledge is managed through IT systems. Furthermore, this reports shares experiences from two hospitals.

9.2. Further research

The research indicates the need for further research on possibilities to improve the efficiency and the quality of the hospital by implementing tacit knowledge management and IT systems. This further research can test the effectiveness of recommendations. Moreover, this research has given an approach for implementing tacit knowledge through IT systems in the future that need to be verified. Even tough parts of the process design exists within and outside the hospitals,
Reflection and further research

there are no experiences with this exact approach. Further research might clarify the strength for this approach.

To gather more input for possible improvements further research might also investigate experiences in other hospitals within and outside The Netherlands. During the research, the Maasland-ziekenhuis in Sittard\(^68\) (NL) and the Knappschaftskrankenhaus\(^69\) in Bottrap (Germany) have been mentioned as a good example of IT supported processes and a successful introduction of clinical pathways.

Research to lower the obstacles would significantly benefit to the possibilities for hospitals to implement knowledge management and IT solutions. Large barriers were the technical and organizational complexity and the technology acceptance under the users. Finding ways to deal with these barriers can provide hospitals with useful solutions.

Besides testing the recommended process approach and investigating possible improvements in other hospitals, further research questions can also be related to aspects like:

- Involving the patient in finding solutions for improvements. After all, the patient determines the quality of the patient care.
- The ethical aspects of more and more automation and IT in the processes in the hospital.

Pilots are a safe way to test new solutions; however, it is important that the experiences of these pilots are distributed. Again, knowledge management and IT systems can benefit to spread the results of case studies. Researching, or implementing ways to effectively share lessons learned from these projects, can be very beneficial to reach the improvement of efficiency and quality in health care.
Notes

1 Literature research on the topic of knowledge management in health care shows a niche in practices, especially in The Netherlands. Respondents of the case studies in this research, like Smits, remarked in the interviews that not much research has been done on how the mind of the medical professional really works. (source: interview with Paul Smits, chairman of the Board of Directors from MCRZ)

2 These questions are the starting questions that I asked myself based upon the sketch problem. Many reasons – like the impossibility to measure quality and efficiency – that will be uncovered in chapter 2, lead to sharpened research questions in chapter 3.

3 It is generally agreed on that the Dutch health care system operates at an insufficient efficiency and quality. Authors like Berg (2001) state that the Dutch health care system disappoints in this manner. Arguments will follow in the remainder of this section.

4 Dimensions are taken from Committee on Quality of Health Care in America (2001).


6 Literature study and case studies did not reveal any clear examples of knowledge management practices in hospitals in The Netherlands. See also note 1.

7 Figure taken from Jillinda e.a. (2000): https://www.educase.edu/ir/library/pdf/EQM0044.pdf

8 By comparing scores from ‘slow’ chess tournaments and ‘fast’ marathon chess tournaments Burns (2003) concluded that in 80% of the games the winner would be the same, because of his chess skills. Speed chess reduces the possibilities to search for the right moves and calls for the real chess ‘tact’ knowledge.

9 Tobias Bruning professional at MCRZ explained the importance of direct contact between medical professionals with the example of cooking in the kitchen. To a large extent knowledge in the hospital is being exchanged in the hallways. This direct contact between professionals is like watching the cook preparing the food, where reading a recipe will not lead to the same result. (source: interview with Bruning, cardiology)

10 In literature about Communities of Practices (CoPs) central issues are the administration, the amount of bringing and getting, and the support with IT systems. For more information see authors like Wenger (http://www.ewenger.com) and Lave.

11 Daniel Barbiero elaborates on tacit knowledge in the Dictionary of Philosophy of Mind. Source: http://philosophy.uwaterloo.ca/MindDict/tacitknowledge.html

12 This number has been calculated based on the 125 thousand FTE and 89 general hospitals in The Netherlands. (source http://www.cbs.nl/nl-NL/menu/themas/mens-maatschappij/gezondheid-welzijn/publicaties/artikelen/2006-1904-wm.htm)


14 Case study in the MCRZ revealed a ‘hate–love relationship’ between the IT support and the professionals. Professionals perceive the supporting staff solutions as suboptimal. Supporting staff managers stimulate their personnel to tighten this gap, for instance by visiting the primary process. At the MCRZ this distance has lead to the conclusion that IT projects can better initiated by professionals than by supporting staff. (source: interview with Van Donselaar, neurology)


Notes

17 During the case study in LUMC at the department gynaecology two team leaders manage around 60 nurses (38 fte). (source: interview with Fennate Huiberts, nurse team leader at LUMC)
18 About six general hospitals have chosen to take in doctors in their own organization. (source: interview with Marc van Aart, medical director of MCRZ)
19 In LUMC all doctors are on the payroll of the hospital to tighten the gap between professionals and the organization.
20 Sentence taken from: http://www.nurseco.co.uk/matildanurse/
21 Figure taken from CBS Web Magazine 3 April 2006, available online at CBS website http://www.cbs.nl/nl-NL/menu/themas/mens-maatschappij/gezondheid-welzijn/publicaties/artikelen/2006-1904-wm.htm
22 In January 2006, about 30 managers from different health care organizations have been approached to find out what the current status of knowledge management in the sector is. All of them agreed with the potential of knowledge management, when just a few have also put it on the agenda of their organization. Not knowing where to start implementing knowledge management was the main reason for the lack of attention to knowledge management.
23 There are two types of artificial intelligence (AI) generally known: strong and weak AI. Strong AI interprets information and performs actions upon this information, hereby approaching the way the human mind works. Applications of this type of AI are not yet realized. Weak AI applications do exists. They are usually in the form of intelligent search engines that are able to find answers to questions based upon intelligent text comparison.
24 This investigation is made based upon the two case studies, contacts with employees from other hospitals and internet and literature research on IT-developments.
25 Electronic patient record (EPR) is the English term for what is known in Dutch as the ‘elektronisch patiëntendossier’ (EPD). These EPR consist in many different forms: elektronisch medicatie dossier (EMD), elektronisch verpleegkundig dossier (EVD) are generally know. Specific departments have their own record systems (i.e. elektronisch diëtistendossier, EDD), like special terms exist for specific sectors (i.e. elektronische kinddossiers, EKD). See for more information http://www.nictiz.nl
26 In 2006 the BSN will be implemented in The Netherlands, an unique number for every civilan in The Netherlands, that allows different applications in health care organizations to link information about patients efficiently: More info see: http://www.programmbsn.nl
27 See for more information about the PACS chapter 6. In chapter 6 PACS is used as an example experience in both case study hospitals.
28 Rules and regulation in The Netherlands forbid patient information to be sent over public networks as Internet. Faxing is not allowed either. This forces information to be sent between organizations by snail mail, or transferred during a telephone call.
29 Source: interview with Canrinus (manager IT department at MCRZ).
30 Source: http://www.estylesoft.com/?id=317&pid=23
31 The minister of health care (Hogervorst) asked KPN CEO Ad Scheepbouwer to investigate the status of IT in the health care sector. Different experts should give their evaluation and suggestions for improvements in the program Sneller Beter: http://www.snellerbeter.nl
32 Several people admit that not much ethical research has been done to investigate the ethical consequences of automated decision-making and literature research shows a niche here.
33 Between the brackets, there is the chapter in which the question is answered.
34 The Talma Sionsberg hospital in Dokkum (Friesland) is the smallest hospital in The Netherlands, with under 800 employees (source: http://www.talmasionsberg.nl)
35 The Amphia ziekenhuis in Breda and Oosterhout is the largest ‘algemene ziekenhuis’ in The Netherlands, with over 5000 employees. (source: http://www.amphia.nl)
36 The MCRZ counts 3500 employees. (source: http://www.mcrz.nl/patienten/opname/opnameboekje.pdf)
37 The hierarchical structure followed from a culture profile of the LUMC that De Bes made for her MBA study. De Bes is head of the department for dieticians. She has a management background. De Bes evaluated the distances between management and professionals. (source: interview with De Bes, head of department for dieticians)
38 Taken from www.lumc.nl
39 More information about the case studies can be found in chapter 6 and in the reports of the interviews online.
The new location has been designed ready for the future hospital. The new location is close to station Lombardijen in Rotterdam. (source: interviews with Smits, Stevens and Arnoldy)

More information about the case studies can be found in chapter 6 and in the reports of the interviews online.

All interview reports can be found at: http://www.laurensvaling.nl/afstuderen


The STZ is the ‘stichting top–klinische ziekenhuizen’ in which top–clinical hospitals co–operate to reach high quality. One of the main criteria to enter the co–operation is to have an extensive educational program. The MCRZ is adding a few extra educational activities this year that would allow them to enter the STZ in 2006.

Managers at MCRZ write a vision 2012 – together with professionals – to define the direction in which they want to steer the organization. Setting clear organizational goals proved to be very important in interviews with managers from MCRZ (source: i.e. interview with Paul Smits)

The Dutch ministerie of health care introduced the ‘diagnose behandel combinaties’ in 2006. These dbc’s are preformatted combinations of diagnosis and treatments. The systems links the finances with allowed combinations, to require an uniform way of working between health care organizations. There has been criticism for the new system because it’s implementation required an enormous administrative ballast.

Directeur patiëntenzorg of the MCRZ (source: interview with Rob Stevens)

In the LUMC protocols are stored on the local intranet (AlbinusNet). In the MCRZ a special system DKS–e (Document Kwaliteits Systeem) has been implemented to store protocols in a central accessible place.

LUMC manager tries to create a problem solving and a learning culture where making mistakes is allowed, as long as there is a learning effect. People that work hard also make the most mistakes, once you disallow making mistakes you force people to work less hard. (source: interview with Erik Flikkenschild)

Source: interview with Frank Arnoldy, directeur beheer at MCRZ.

A culture study by Caroline de Bes indicated that the culture at LUMC can characterized as very hierarchic. De Bes did the study for her MBA study. (source: interview with De Bes)

Based on information given by Jeanet van der Stel, nurses do not work conform well known check and control mechanisms. There is no time for evaluation of the work processes. (source: interview with Van der Stel)

Transmural is the official translation to represent the Dutch word ‘transmuraal’. Transmural means through any wall, as of the body or of a cyst or any hollow structure, and in the health care it is used to typify the coordination of health care processes between different organizations.

The first program manager job is vacant, with the program managers EPR and external relations interviews have been held. Both program managers are medical professionals that run the programs in a few hours a week next to their medical function. (source: interview with Bruning and interview with Van Donselaar)

The big–registration is a central registration of functions that deliver individual health care (‘beroepen in de individuele gezondheidszorg’). The registration ensures the quality of health care professionals. Once finished the study different professionals (including nurses) get this registration. From 2010, nurses have to follow studies to maintain their registration.

Based on the list of requirements the hospital chose the cheapest system that met all the requirements. Even though a more expensive system was preferred by the professionals, they had to accept the other system because of the requirements set by the users themselves.

Chairman of the board of directors Smits predicted that before a professional infrastructure, IT support and EPR have been realized the MCRZ is five years further. Only from 2010, the MCRZ can start thinking about ways to support the decision–making in the primary process.

User of the application Van Donselaar demonstrated how the application needs about one minute to boot, and how many mouse–clicks are needed to get the right picture on the screen. (source: interview with Van Donselaar)

Source: interview with Evelyne van Loon, nurse at neonatology department at LUMC.

Both in the LUMC and the MCRZ managers indicated that implementing new systems is usually easier for the group of professionals than for nurses. The reason for this is that doctors have more competence to
adapt to new systems and change situations. (source: interviews with managers Van Lambalgen (LUMC) and Van Aart (MCRZ)).

Interviews with IT managers Caninus (MCRZ) and Van Lambalgen (LUMC) showed that IT departments have supportive role and that IT staff members are being taught how to act supportive. (source: interviews with Caninus and Van Lambalgen)

Clinical pathways have been introduced in the German Knappschaftskrankenhuis in Bottrap. Different processes are linked together. The doctors walk around with tabloid pc’s and manage the clinical paths of their patients. The result are clear, a more efficient, intelligent and effective health care process. Source: www.imedone.com.

Examples for this are found at www.nederlandbreedbandland.nl.

Project management is the discipline of defining and achieving targets while optimizing (or just allocating) the use of resources (time, money, people, materials, energy, space, etc) over the course of a project (a set of activities of finite duration). More info: http://www.pmi.org

Taken from De Bruijn, Ten Heuvelhof and In’t Veld (2002), page 46.

De Bruin and Ten Heuvelhof (1999) describe seven paradoxes of hierarchical steering, that are worth considering when implementing a process design.

Contact persons for this research were Karel van Lambalgen (Directeur Informatiseren en automatisering in LUMC) and Marc van Aart (Directeur medische zaken in MCRZ).

In 1999, the Maaslandziekenhuis in Sittard was allowed to rebuild completely and the Minister of health care (Borst) asked to make the hospital fully automated and IT ready. (source: http://www.ict-kenniscongres.nl/?m=42&p=6)

In the German Knappschaftskrankenhuis in Bottrap, clinical pathways have been introduced to operate more efficiently. Different processes are linked together. The doctors walk around with tabloid pc’s and manage the clinical paths of their patients. The result are clear, a more efficient, intelligent and effective health care process. A demonstration movie can be found at: www.imedone.com.
References


Methods of Information in Medicine 37, 206–310.


Cross (2002) Using social network analysis to improve knowledge creation and sharing. IBM.


References


References


Appendix I: Analysing interviews
Appendix I: Analysing interviews

Contents
Table 12: MCRZ Managers
Table 13: MCRZ Professionals
Table 14: LUMC Managers
Table 15: LUMC Professionals
Table 16: LUMC Nurses

Interview reports for each interview can be found online at

http://www.laurenswaling.nl/afstuderen

Overview of respondents

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>Manager</th>
<th>Professional</th>
<th>Nurse</th>
<th>Staff</th>
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<tbody>
<tr>
<td>Karel van Lambalgen</td>
<td>Directeur Informatievoorziening</td>
<td>(x)</td>
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<tr>
<td>en Automatisering</td>
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<tr>
<td>Robert Holl</td>
<td>Hoofd Kindergeneeskunde</td>
<td>(x)</td>
<td>(x)</td>
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<tr>
<td>Erik Flikkenschild</td>
<td>Directeur beheer</td>
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<td>(x)</td>
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<td>Hans van Raamt</td>
<td>ICT</td>
<td>(x)</td>
<td>(x)</td>
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<td>Joan Meekel</td>
<td>Hoofd verpleegkundige</td>
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<td>(x)</td>
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<td>Caroline de Bes</td>
<td>Hoofd afdeling diëtetiek</td>
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<tr>
<td>Marlies Lagendijk</td>
<td>Dietist</td>
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<td>Lenneke Elderbroek</td>
<td>Dietist / Manager Valent RDB</td>
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<tr>
<td>Martine de Clercq</td>
<td>Vrijgevestigde diëtist</td>
<td>(x)</td>
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<tr>
<td>Barbara Romsom</td>
<td>Teamleider Psychiatrie</td>
<td>(x)</td>
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<td>Fennate Huiberts</td>
<td>Teamleider verloskunde</td>
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<tr>
<td>Eveline van Loon</td>
<td>Verpleegkundige neonatologie</td>
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Table 10: Respondents LUMC

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<tr>
<th>Name</th>
<th>Function</th>
<th>Manager</th>
<th>Professional</th>
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<th>Staff</th>
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<tr>
<td>Paul Smits</td>
<td>Voorzitter Raad van Bestuur</td>
<td>(x)</td>
<td>(x)</td>
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<tr>
<td>Mark van Aart</td>
<td>Directeur medische zaken</td>
<td>(x)</td>
<td>(x)</td>
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<tr>
<td>Rob Stevens</td>
<td>Directeur patiëntenzorg</td>
<td>(x)</td>
<td>(x)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frank Arnoldy</td>
<td>Directeur beheer</td>
<td>(x)</td>
<td>(x)</td>
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</tr>
<tr>
<td>Tjeerd Caninus</td>
<td>Hoofd ICT</td>
<td>(x)</td>
<td>(x)</td>
<td></td>
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</tr>
<tr>
<td>Jeanet van der Stel</td>
<td>Stafmedewerker</td>
<td>(x)</td>
<td>(x)</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Cees van Donselaar</td>
<td>Neuroloog (beleid EPD)</td>
<td>(x)</td>
<td>x</td>
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<tr>
<td>Tobias Bruning</td>
<td>Beleid extranet ICT en omgeving</td>
<td>(x)</td>
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<tr>
<td>Frederik Santman</td>
<td>Internist / intensivist</td>
<td>x</td>
<td></td>
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<tr>
<td>H.T. Teng</td>
<td>Radioloog</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ronald van der Lely</td>
<td>Radioloog</td>
<td>x</td>
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Table 11: Respondents MCRZ

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### Table 12: MC2R Managers

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<th>Requirements</th>
<th>Professionals</th>
<th>Nurses</th>
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<tr>
<td>- Enhance efficiency (E)</td>
<td>- Enhance efficiency (E)</td>
<td>- Enhance efficiency (E)</td>
</tr>
<tr>
<td>- Increase quality (Q)</td>
<td>- Increase quality (Q)</td>
<td>- Increase quality (Q)</td>
</tr>
<tr>
<td>- Compete in top 20 clinical hospitals (ST2) (3)</td>
<td>- Reduce waiting times (I)</td>
<td>- Reduce waiting times (I)</td>
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<tr>
<td>- Treat more patients (3)</td>
<td>- Become a low-cost leader (2)</td>
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<tr>
<td>- Reduce waiting times (I)</td>
<td>- Increase competences to reach quality (Q) (1)</td>
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<tr>
<td>- Increase competences to reach quality (Q) (1)</td>
<td>- Increase competences to reduce mistakes (1)</td>
<td>- Increase competences to reduce mistakes (1)</td>
</tr>
<tr>
<td>- Focus on primary process (outperforming) (2)</td>
<td>- Increase time for administrative processes (1)</td>
<td>- Increase time for personal coaching (1)</td>
</tr>
<tr>
<td>- Train and manage competences of employees (2)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>- Reduce mistakes (1)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>- Recruit well educated personnel (1)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>- Focus on quality in culture (2)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>- Communicate with professionals and nurses (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Create a patient–central culture (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Full-time employees are the key to quality (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- IT needed (5)</td>
<td>- IT needed (5)</td>
<td>- Optimized communication through IT-systems (1)</td>
</tr>
<tr>
<td>- Optimized communication through IT-systems (4)</td>
<td>- Optimized communication through IT-systems (2)</td>
<td>-</td>
</tr>
<tr>
<td>- Professional IT support needed (1)</td>
<td>- Standardized way of working (2)</td>
<td>-</td>
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<tr>
<td>- Key performance indicators necessary (management information) (2)</td>
<td>- All patient data accessible through EDP (1)</td>
<td>-</td>
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<tr>
<td>- Professional IT-communication systems (3)</td>
<td>- Work-flow management needed (1)</td>
<td>-</td>
</tr>
<tr>
<td>- Processes aligned by ‘target’, monitored by IT, CMM-model step 5 (2)</td>
<td>- Decisions supported by database statistics (1)</td>
<td>-</td>
</tr>
<tr>
<td>- In 5 year paper free (1)</td>
<td>- Decisions based on tacit knowledge (1)</td>
<td>-</td>
</tr>
<tr>
<td>- Protocol system (OKS-e) (6)</td>
<td>- Time saved for regular decisions, increased time for irregular patients (1)</td>
<td>-</td>
</tr>
<tr>
<td>- Access from home to systems (1)</td>
<td>- Professional steps in control of IT, final decisions can never be fully automated (3)</td>
<td>-</td>
</tr>
<tr>
<td>- Facilitating role IT-department (1)</td>
<td>- Overview within IT-applications</td>
<td>-</td>
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</table>

### Challenges

<p>| | | |</p>
<table>
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<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Very complex organization (5000 employees, 256 jobs) (2)</td>
<td>- Nurses work very routinely and its hard to put extra quality in work (1)</td>
<td>-</td>
</tr>
<tr>
<td>Secure fusion nested internal oriented (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seson mixing into new building (1)</td>
<td></td>
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</tr>
</tbody>
</table>

### Obstacles

| Missing IT competences (3) | Missing IT competences (3) | Missing IT competences (1) |
| General management expertise level too low (often external experts needed) (1) | Missing overview of possible IT innovations (2) | Physical work does not require education after study (1) |
| Too less attention for primary process because ‘target’ and IT- problems (1) | Professionals don’t want decision makers to take over (1) | Research area is not developed (1) |
| Competences overview not available (1) | | |

### Opportunities

| | | |
| -- exceeding organization by reducing management | An IS&A commission has been formed with care professionals to manage IT developments | |
| - Become a member of ST2 (apply) | | |
| - Client panel evaluates supporting staff solutions | | |
| - An framework has been developed to evaluate projects on their added value versus costs | | |
| - A vision 2013 is being written including goals (increase market share, improve quality, operate at low costs and make less mistakes) | | |
| - Input is being gathered for this vision in meetings with professionals | | |
| | | |
| - Improve the quality of the IT department through internal management | New IT projects are initiated by care professionals | - Protocols are being formed |
| - Department education guides toward teaching hospital | IT projects are managed by care professionals | - From 2011 nurses should keep on studying during work to keep RC registration |
| - An internal consultancy department advice at different IT projects, they focus on solving language problems (IT PRINCE2) UK information can be shared effectively | Professionals indicate competences on the internet, a list with competences of specialists is available to find each other | - |
| | | |
| | | |
| | | |
| | | |
## Table 12: Interviews MCRZ managers (Smits, Stevens, Van Aart, Arnolde and Canirius)

<table>
<thead>
<tr>
<th>Requirements:</th>
<th>Requirements: increase competences to reach quality, reduce the number of mistakes, etc.</th>
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<tbody>
<tr>
<td>Enhance efficiency and quality, reduce waiting times, increase the number of patients treated</td>
<td>Obstacles: missing IT competences, current IT solutions are laid down by IT staff and do not suit medical professionals, missing competences to see IT innovations, professionals do not want others to take over their decisions</td>
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<tr>
<td>Achieve goals set in vision for the next years, communicate these goals and initiate projects to reach goals</td>
<td>Conclusions:</td>
</tr>
<tr>
<td>- Set clear goals in vision for the next years, communicate these goals and initiate projects to reach goals</td>
<td>- Medical professionals and IT staff should meet each other</td>
</tr>
<tr>
<td>- Reduce complexity in organization by less hierarchy, standardization of skills and direct communication</td>
<td>- Show IT innovation possibilities to medical professionals, train in IT competences</td>
</tr>
<tr>
<td>- Enhance quality by becoming member of STZ and setting quality as a central goal</td>
<td>- Introducing IT solutions should be instigated by (selected group of) medical professionals instead of IT staff</td>
</tr>
<tr>
<td>- Evaluate solutions and way of working by getting feedback from selected groups and listening to the primary process</td>
<td>- IT staff should evaluate IT solutions can be reached</td>
</tr>
<tr>
<td>- Involve the primary process (doctors and nurses) by creating a long list of projects</td>
<td>- Make sure the solutions as created by IT staff are used in the right way</td>
</tr>
<tr>
<td>- Can’t do everything at the same time, select the best projects that add most to efficiency and quality of the primary process</td>
<td></td>
</tr>
<tr>
<td>Align projects in reaching these goals</td>
<td></td>
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<td>- Can’t do everything at the same time, select the best projects that add most to efficiency and quality of the primary process</td>
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<tr>
<td>Align projects in reaching these goals</td>
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</tr>
<tr>
<td>Obstacle</td>
<td>Professional</td>
</tr>
<tr>
<td>----------</td>
<td>--------------</td>
</tr>
<tr>
<td>- The hospital is a very complex organisation, with complex processes (2)</td>
<td>- To fix IT competences to see improvements with IT (3)</td>
</tr>
<tr>
<td>- Lack of finances to invest (1)</td>
<td>- IT department is not aware of the logistics in primary process (2)</td>
</tr>
<tr>
<td>- Business case for IT is not clear</td>
<td>- No motivation for IT developments because of all problems concerned with it (3)</td>
</tr>
<tr>
<td>- High-level relation with IT department (2)</td>
<td>- Large distance between professionals and IT department (3)</td>
</tr>
<tr>
<td>- IT projects from IT department, no added value for clinicians (1)</td>
<td>- Only if added value is clear there is motivation (2)</td>
</tr>
<tr>
<td>- Juridical consequences are large when communication is digital available (in ERP) (1)</td>
<td>- IT projects cost more time for doctors and nurses instead of less (1)</td>
</tr>
<tr>
<td>- No critical mass of users to sell IT department wishes (1)</td>
<td>- No critical mass of users to sell IT department wishes (1)</td>
</tr>
<tr>
<td>- To less ambition in IT department to user developments (1)</td>
<td>- Problems with information sources (1)</td>
</tr>
<tr>
<td>- No critical mass of users to sell IT department wishes (1)</td>
<td>- Responsibility for information is not defined (1)</td>
</tr>
<tr>
<td>- Lack of IT use (1)</td>
<td>- No procedures exist for signaling problems (1)</td>
</tr>
<tr>
<td>- Small amount difficulties with working on computer (1)</td>
<td>- IT projects cost more time for doctors and nurses instead of less (1)</td>
</tr>
<tr>
<td>- The key to quality is to become aware what quality really is</td>
<td>- Number of technical systems that function individually from each other create a complex environment for introducing new systems (3)</td>
</tr>
<tr>
<td>- Implementing a new system is easier when explained how it improves quality and helps patients</td>
<td>- Immediate implementation leads to resistance (“it’s not ours” (1)</td>
</tr>
<tr>
<td>- Shows examples to reach motivation</td>
<td>- Next time we need to display all relevant information at the same time (needed for medical decision making) (1)</td>
</tr>
<tr>
<td>- Medical professionals are grouped to initiate IT projects</td>
<td>- Communication important to implement systems</td>
</tr>
<tr>
<td>- Representatives of users decide about requirements for new systems</td>
<td>- Education in multidisciplinary teams, to require insight in each other processes</td>
</tr>
<tr>
<td>- IT commission has been formed with medical professionals, to advise the hospital about IT policy</td>
<td>- Medical profession must give medical advice (3)</td>
</tr>
<tr>
<td>- Helps link in department created to support professionals with PACS</td>
<td>- The key to quality is to become aware what quality really is</td>
</tr>
<tr>
<td>- Education in multidisciplinary teams, to require insight in each other processes</td>
<td>- Medical professionals must give medical advice (3)</td>
</tr>
<tr>
<td>- The key to quality is to become aware what quality really is</td>
<td>- Organizations need to support system</td>
</tr>
<tr>
<td>- Implementing a new system is easier when explained how it improves quality and helps patients</td>
<td>- Show examples to reach motivation</td>
</tr>
</tbody>
</table>
### Conclusion

**Requirements:** the focus of the organization is to increase quality, reduce costs (more efficient working) and reduce waiting times (preferably in a flat organization).

**Obstacles:** the hospital is very complex organization to manage and improve

**Conclusions:**
- It's difficult to change the traditional organization, where professionals play such an important role

### Case 1

**Requirements:** although the final decisions will always be made with tacit knowledge, IT systems can facilitate medical decision making to a large extent, this will allow medical treatments to be done more efficiently and allow for personal contact; besides supporting IT this (tacit) knowledge exchange is required as well, the professional is central in decision making

**Obstacles:** IT department is not aware of possible improvements in primary process, however professionals have no insights in IT possibilities; professionals are expensive and redundancy is not allowed

**Conclusions:**
- Show the field the possibilities of IT
- Form multidisciplinary teams, evaluate logistics and come with solutions, solution is send to IT department
- It can make the knowledge of the professionals available in situations where they are not available
- The professional always keep the final decisions based upon tacit knowledge, because the human body is too complex for IT systems

### Case 2

**Requirements:** professionals prefer a working culture with short communication lines, less administrative work, the professional is central, supported by IT

**Obstacles:** large gap between IT staff and professionals leads to no motivation for IT projects and all problems concerned with it, only if there is real added-value there is room for improvements

**Conclusions:**
- Motivate professionals to come with improvements
- IT staff should come out the primary processes, to lighten the gap between the two

### Case 3

**Requirements:** IT is highly needed to streamline processes and make them more efficient, IT can facilitate communication, exchange information around patients and share knowledge; IT can also support medical decision making with models and statistics

**Obstacles:** Large investments needed, but business case for IT is difficult to calculate because profit is to a large extent invisible, technical and organisational complexity make improvements very difficult, IT can never fully replace face-to-face contact

**Conclusions:**
- IT projects start with knowledge of the primary processes
- Look for improvement space with professionals
- Look at other hospitals for inspiration (just copy, no need to invent)
- Create a knowledge database of possibilities, sort ideas on feasibility
- Formalise plans, test on feasibility with IT department
- Business case difficult to develop, however often possible

### Case 4

**Requirements:** to increase quality working according to protocols and awareness of processes in other departments is necessary

**Obstacles:** differences in the way of working

**Conclusions:**
- Defining protocols requires over the border view and knowledge exchange
- Working in interdisciplinary teams increases insight in each others processes
- Tacit knowledge needs to be made explicit
- Requires knowledge management approach Talking about quality increases quality awareness

### Case 5

**Requirements:** a quality and customer oriented attitude is required

**Obstacles:** work is carried out traditionally without much awareness; it’s difficult to motivate people in routine jobs, IT is not part of the culture

**Conclusions:**
- Improve quality by introducing protocol systems (NSIS-e)
- Implementing new system is difficult process because of technical and organizational complexity

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Table 13: Interviews MCRZ professionals (Van der Stel, Van Donselaar, Bruning, Santman, Teng, Van der Leefy)
<table>
<thead>
<tr>
<th>Obstacles</th>
<th>Management</th>
<th>Professionals</th>
<th>Nurses</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Communication is difficult with nurses that work in shifts, they can never meet all at the same time (3)</td>
<td>- No clear position of IT in the organization (2)</td>
<td>- The organization is very hierarchical (1)</td>
<td>- Transcultural working requires coordination between people concerned, this coordination needs to be made explicit (1)</td>
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<th>Nurses</th>
</tr>
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<tbody>
<tr>
<td>- Transcultural network to coordinate transcultural working</td>
<td>- IT support on each division (to better represent the users) as well as central support staff</td>
<td>- Many IT projects are not accepted by professionals (2)</td>
<td>- Standardized working is too small extent applicable on the complexity of the human body (1)</td>
</tr>
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<td>- A workplace communication publishes a newsletter with developments</td>
<td>- Resistance to new IT systems, low technology acceptance (1)</td>
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### Conclusions

| Requirements: Increase necessary competences and knowledge level | Conclusions: To exchange knowledge is important to know each other and to know who has which competences | Conclusions: No information available based on these interviews |
| Requirements: Increase necessary competences and knowledge level | Conclusions: To exchange knowledge is important to know each other and to know who has which competences | Conclusions: No information available based on these interviews |
| Requirements: A knowledge sharing and problem solving culture, where IT solutions are part of the set of mind, get to know each other to get the team work done | Conclusions: Culture characterized by technology acceptance and distance between IT staff and professionals | Conclusions: A quality attitude is needed to deliver quality, IT is not yet part of culture |
| Requirements: IT can be very beneficial to each quality, efficiency, because IT facilitates information and knowledge exchange and it standardizes the way of working | Conclusions: IT presents making mistakes and allows for improved communication, however, many IT projects do not lead to successes | Conclusions: IT saves time and leads to better quality of care, however, human stay important because of complexity of the human body |
| Requirements: Communication and coordination is difficult inside and between organizations | Conclusions: No information available based on these interviews | Conclusions: No information available based on these interviews |

Table 14: Interviews LJMCL managers (Van Lambalgen, Huij, Flikkenschild, De Ber, Meekel)
<table>
<thead>
<tr>
<th>Obstacles</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Different organizations have different systems (1)</td>
</tr>
<tr>
<td>- Protocols are different between organizations (2)</td>
</tr>
<tr>
<td>- Because of differences protocols can hardly be exchanged (2)</td>
</tr>
<tr>
<td>- Standardization is needed for EPR (2)</td>
</tr>
<tr>
<td>- Patient information cannot be sent over the internet or fax (safety legal) (1)</td>
</tr>
<tr>
<td>- IT in healthcare is far beyond IT in businesses (1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Transurban network to organize cooperation between organizations in region</td>
</tr>
<tr>
<td>- Competition between organizations is not dominant and knowledge is openly exchanged</td>
</tr>
<tr>
<td>- Organization can profile themselves through the network</td>
</tr>
<tr>
<td>- Network meetings to get to know each other and exchange knowledge</td>
</tr>
<tr>
<td>- On the community site is a list of participants and their specialties</td>
</tr>
<tr>
<td>- Knowledge is exchanged through professionals workgroups (mailing lists and forums)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Requirements: to increase quality, cooperation of different professionals is needed to reach one patient center care system coordination between professionals is necessary</td>
</tr>
<tr>
<td>- Obstacles: competitive organizations need to work together</td>
</tr>
<tr>
<td>- Conclusion: An inter-organizational approach is needed to coordinate the healthcare processes in different organizations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Requirements: to increase quality competences are needed in the network, one needs to know which competences are where available and knowledge needs to be exchanged to allow organizations to specialize</td>
</tr>
<tr>
<td>- Obstacles: it’s difficult to get to know each other specialties, staying up-to-date about all quick developments is very time consuming and time is not available for research and education, because patients are waiting</td>
</tr>
<tr>
<td>- Conclusion: There is a common notion that coordination and knowledge exchange is needed, however, reaching this in practice, under pressure from daily tasks is difficult</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Requirements: an IT minded culture is needed when IT is used to get to know each other and exchange knowledge efficiently, must continuously up-to-date and perform research and educational tasks efficiently</td>
</tr>
<tr>
<td>- Obstacles: professionals need time to get used to systems and need to know each other before using IT</td>
</tr>
<tr>
<td>- Conclusion: The culture is not yet IT minded</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Requirements: IT is needed to facilitate communication and knowledge exchange, however, there is a lack of standardized working</td>
</tr>
<tr>
<td>- Obstacles: Many different systems in organizations, protocols are organization specific</td>
</tr>
<tr>
<td>- Conclusion: It can play an important role to standardize the way of working</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>- It is very difficult to define standards for information exchange when different systems and different ways of working are used</td>
</tr>
</tbody>
</table>

| Table 15: Interviews LUMC professionals (Lagendijk, Elderbroek, De Clercq) |
| Table 16: LUMC nurses (Van Raam, Romson, Huiberts, Van Loon) |
|-------------|----------------|
| **NURSES** | **REQUIREMENTS** |
| - Communicate efficiently (4) | - Quality of health care central focus, delivering service to patients (3) |
| - Work more efficiently (2) | - Work with EHR (4) |
| - Improve quality with digital services to patient (1) | - Further digital communication (3) |
| - Knowledge exchange to increase quality (2) | - Reduce paper work (3) |
| - IT competence (they need it for the future) (3) | - All protocols digital available (2) |
| - Business case for knowledge management is difficult, but feelings tell that it will be important (1) | - Keep IT simple, everyone should understand it immediately (2) |
| - Communication is very important (1) | - Website for the department (1) |
| - Nurses are responsible to stay up-to-date (2) | - Standardized way of working (1) |
| - Managers are focused on costs and less on creativity of the nurses to deliver high quality care (1) | - EPR give a clear overview, prevents mistakes and saves time (1) |
| **OBSISTANCES** | - EPR give insight in doctors conclusions (1) |
| - Communication is difficult because of working in shifts (5) | - EPR summarize patient information (1) |
| - Not everywhere are systems used the same way and the same amount (2) | - Improved systems for communication (Share Point) (5) |
| - More computers (2) | - Exchange EPR country wide through standards (5) |
| - Parallel use of communication systems (2) | - Find new systems that are more user friendly and have more functionalities (1) |
| - There is an overhaul of information being written down now (1) | **EXPERIENCE** |
| - Systems cannot be reached from home (1) | - Digitalizing work processes from bottom-up, also implementing bottom-up proved successful: |
| - Nurses have to learn with many new applications in a short time (overload) (1) | - Nurses should give new input on systems, they know what they want |
| - To much information cannot be interpreted (1) | - Most nurses already have basic IT competences from home |
| | - The way Atrius is used shows how nurses can handle IT systems |
| | - A nurse developing an IT solution proved very efficient and successful |
| | - The creation of an own system between the systems of the hospital lead to resistance in the IT department |
| | - An perfect implementation would be a big bang scenario, however, in practice, users need a evolutionary approach |
| | - Creating a good system requires involvement in what the users really want |
| | - IT is already used for some applications: internet, intranet, email and protocols |
| | - Atrius is very popular for communication |
| | - Subjects are discussed online through Atrius |
| | - Atrius is being used successfully |
| | - Working with an EPR is very user friendly, prevents mistakes and increases quality |
| | - The success of the application is not the technology, but the correct use of the system by the organization |

**Conclusions:** For the nurses working in shifts it is very important to communicate efficiently, deliver efficient high quality care with the best services to the patients. Creativity and real patient care is under pressure because of costs and production focus on management. It proved to be an important role in facilitating the communication. It can further be used to deliver more services and quality to the patients. It is important for management not to kill quality and creativity in patient care. Nurses can give input to IT systems, because they know what they want to improve.

**Requirements:** Knowledge management has a potential to increase quality, this can be reached by IT systems. Especially a new generation seems to be used to IT. Knowledge is not yet shared, and there is no expertise with methods for sharing it, still it seems potential. Nurses with IT competences proved to be an effective combination for innovation.

**Requirements:** It is important to stay up-to-date in developments, good communication is required. Still much more improvements can be reached, by creating better systems, integration of systems and more user friendly interfaces. Allowing computer skilled nurses to initiate improvement projects proved to be very beneficial. The real success of a new systems is not the technology, but the correct use of the system by the organization.
Appendix I: Analysing interviews
Appendix II: Process design

The steps are in the process design are:

Round I: Initiation
1. Form interdisciplinary workforces
2. Gather experience
3. Identify possible improvements

Round II: Solution building
4. Orchestrate processes
5. Design IT solutions

Round III: Project selection
6. Calculate business cases
7. Select projects

Round IV: Project execution
8. Project management
9. Create a sense of urgency
10. Create trust
11. Use IT facilitating

Round V: Project termination
12. Evaluation

I elaborate on each of these steps to clarify how they have been derived, and the relations between them.

9.2.1. Form interdisciplinary workforces

Teams consisting of different experts can use different competences that are needed to improve the primary process. Following the analysis in the previous chapter, roles in such an interdisciplinary workforce should at least be:

- **A program/process manager** To act as a chairman in the group and protect the core elements of the process design (openness, protection of core values, speed and substance).
- **Management representative** To represent management objectives and maintain the commitment of the strategic board.
- **Logistical expert** To identify possible improvements in the health care processes someone is needed who objectively can oversee information flows.
- **End-users** Section 8.1.4 showed the importance of involving end-users, with the necessary knowledge (partly tacit), in order to improve the primary process.
- **IT expert** People with IT competence are required to demonstrate the potential of IT. It is important that these IT people allow creative thinking, and do not restrain the suggestions clinical crew.

If the members of the workforce strive for the same goals and they simultaneously tighten the distances that exist between management, professionals and IT staff. The different aspects of the knowledge environment should be balanced within the group:
Appendix II: Process design

- **Organizational structure** Describes different roles and responsibilities for the group members and the position of the group within the organization.

- **Competences** All competences, in the group, should be available and preferably balanced.

- **Culture** Allowing for brainstorming, knowledge exchange, etc.

- **Systems** The systems used to i.e. communicate and gather experiences.

Once one or more of these team are formed, the interdisciplinary workforce can continue with the following steps.

### 9.2.2. Gather experiences

One of the first actions of the workforce should be to gather experiences in orchestrating processes, using clinical pathways, implementations of knowledge management and successful IT systems. Solutions do not necessarily have to be reinvented, since there is a lot to learn from other organizations and their experiences. In The Netherlands, the academic hospitals are further in the use of IT than general hospitals are. Some hospitals have recently implemented large improvements. A digital hospital that will be finished in 2008, is under construction in Sittard. Processes in this hospital are embedded in SAP, an Enterprise Resource System (ERP).

Also outside The Netherlands, there have been attempts to establish a more IT based health care system. Germany and the United States are the most advanced countries when it comes to use of IT in hospitals. The Knappschaftskrankenhaus in Germany has been mentioned before as a good example of the implementation of clinical pathways and supportive IT.

The relevant knowledge that is gathered from these experiences should somehow be translated and used in the local situation. It might be considered to start a knowledge database that is accessible for all members in the workforces to share ideas for improvements. Experiences and ideas can be ranked by importance and form a source that can be used when improving the hospital. Not all knowledge can or needs to be codified, as follows from the principle of tacit knowledge, but it is important to make experiences more accessible.

### 9.2.3. Identify possible improvements

With the experiences from abroad in mind, the workforces should take a critical look at the primary process. Processes in the hospitals have evolved and proved themselves for many years. However, new developments in knowledge management and IT create possibilities to increase the efficiency and quality of these processes. The competences of all members in the workforce are needed when you identify these possible improvements. The involvement of the end–users is of utmost importance here, since they can foresee the impact of improvements better than any of the other actors. The analysis showed how solutions from IT experts failed, because experts lacked insight in the real benefits for the primary process. Improvements can be small implementations of a more efficient IT system, or large improvements in redesigning more processes (8.2.4).

The possible improvements should be in line with the organizational goals and strategic policy. To make sure those valuable ideas for improvements land at the right place, the organization needs to know where they can go with their suggestions. Improvement suggestions from actors in the organization need to be taken serious into account.

### 9.2.4. Orchestrate processes

The possible improvements (8.2.3) form input for the orchestration of processes (8.2.4). As concluded in section 8.1, improving the primary processes consist of two steps. First, organize the
processes efficiently as clinical pathways. Second, improve the efficiency even more by designing IT solutions.

Clinical pathways should be designed to enhance the efficiency and quality of the primary process, using the competence of the workforce. Section 8.1.2 elaborated on the design of these clinical pathways and how they could improve the efficiency and quality. Important is that they are designed in harmony with the IT solutions.

Redesigning the processes has a huge impact on the hospital. This step in the process should therefore not be underestimated in terms of complexity and possible impacts. Orchestrating the processes requires an overview of all impacts on other processes, and even on the resources involved. To oversee completely all consequences is impossible, because of the mentioned complexity. This was one of the reasons to recommend a process approach to implement the conclusions.

9.2.5. Design IT solutions
During the orchestration of the processes in clinical pathways, the IT solutions should be designed to increase the quality and the efficiency of the clinical pathways even more. These IT solutions can be either small tools that increase one process in the chain, or large systems that monitor the complete pathway. Section 8.1.3 indicated different possibilities for IT to support the clinical pathways.

IT solutions can be build- or buy-solutions. In case certain solutions are available on the market, it is usually favourable to buy a package. However, in some situations, available packages might not be sufficient and necessary solutions are needed.

For each type of IT solutions, there are guidelines for which criteria it satisfies: important criteria are usually the user-friendliness and the compatibility with current systems. Designing IT solutions requires IT skills, however, the end-users should stay involved to ensure that IT is supportive to the primary processes.

9.2.6. Calculate business cases
Once the improvements have been designed, calculating the business case will give insights on the expected costs and benefits. Based upon these business cases the best improvements that lead to the most benefits can be selected.

The research showed how important the calculation of the business case is; while it at the same time clarified the problems with calculating this business case. The impacts are usually so large that it is impossible to oversee all consequences. In addition, the large, as well as the small impacts can be partly invisible. One of the disadvantages is that the impacts cannot be calculated in money.

Especially in large improvements, like the development of clinical paths, it is difficult to pinpoint the benefits. In some cases, simulation can be helpful to give insights in resources that can be saved because of a more efficient orchestration of processes and an efficient use of IT support. Simulation programs allow for building simulation models through which the efficiency of different alternatives can be calculated. Still, these simulation models provide limited possibilities to measure quality. The research revealed that quality is difficult to measure. Only professionals and nurses are able to incorporate the quality based on their tacit knowledge.
Appendix II: Process design

Investments come before expenses; however, to make investments expenses have to be visible. When the continuation of the project is being questioned, the business case permits reconsideration and recalls the goals of the project.

9.2.7. Select projects
The selection of the most profitable improvements for the hospital, is possible through the different business cases. Projects that have positive business cases can be planned from the improvements, when there are available resources. The executed projects are usually chosen by management, since the management has to invest in the project.

9.2.8. Project management
When a project has been selected to be executed, traditional project management is suitable to fulfil the planning. First, resources need to be found, because money needs to be invested and people have to be found that get time to carry out the project. The workforce is leading, and acts as overall program management. For the execution of the project, a dedicated project team might be formed. Depending on the size of the project, the following roles can be fulfilled within the project:

- A leading person, preferable from within the group of end-users; however, project management skills are needed, depending on the size of the project team. The project manager is responsible for reporting the progress to program management team.
- Additional advising functions can be added. Some hospitals have a pool of competent employees that can help with the execution of projects.
- The IT department is executes the technical implementation of the project.
- A test panel of end-users should regularly test versions (prototypes) of the solution, to ensure the added value to the end users. The test panel can also give input on the requirements for embedding the solution in the organizational.

Project management handbooks provide guidelines for these types of projects, therefore it is unnecessary to dive further into this approach.

9.2.9. Create a sense of urgency
We have seen the importance of a sense of urgency (section 8.1.1). We have also seen that this urgency exists. It benefits to the speed of the process and the implementation, if all actors are aware of this sense of urgency. The creation of such a feeling is therefore an important aspect in maintaining the speed in the process.

9.2.10. Create trust
A sense of urgency and good solutions alone are not enough. The research revealed that in the past there have been some failures of implementations. Literature and case studies showed the importance of creating trust among the end-users. The involvement of the end-users in the process enables this trust, but there are also worthy alternative ways to create trust. Trust can be achieved by showing examples and commitment where the end-users see the benefits of the changes. End-users have to believe that the changes will most of all benefit their work.

The principle of trust is highly tacit (chapter 2) and has to do with culture. One of the ways to make sure the culture in the hospital accepts solutions is to keep the organization informed. The project team has to inform the organization on a regular basis.
9.2.11. Use IT facilitating
The possibilities of IT should not only be used in the solutions, they can also be used when creating the solutions. IT allows the end-users to be involved in the decision-making, since IT makes communication, with a large number of end-users possible. IT can also be used to gather experience within the project team. Finally, IT provides possibilities to keep the organization informed.

9.2.12. Evaluation
The evaluation of the solution is critical. This involves a validation of whether the solution is implemented the way it is supposed to be. Experience has shown that many implementations lead to another type of use than expected. Analysing the use after implementing the project leads to better insight on the project. Lessons learned in projects form an important basis to improve the effectiveness in new projects. An important objective of the evolution is consequently to communicate the know-how further.
Appendix II: Process design
Appendix III: Interview questions

Introductie

Functie | Wat is uw functie binnen het LUMC?
Aandacht KM | Is er in het algemeen aandacht voor kennismanagement bij LUMC?

Case | Kunt u iets meer vertellen over de case en uw rol daarbij?
Wat was het doel van het systeem?
Systeem | Hoe gebruikt u het systeem in het dagelijks werk?

A) Kennis delen met het systeem

Benodigde kennis | Welke kennis heeft u voor uw dagelijks werk nodig?
Rol systeem | Welke rol speelt het systeem bij het delen van kennis?
Introductie van tacit knowledge

Rol systeem | Welke rol speelt het systeem bij het delen van tacit knowledge?
Motivatie | Waarom wilt u kennis delen?
Stimuleren | Hoe kan kennisdelen gestimuleerd worden?

B) Systeem implementatie

Actoren | Wie hebben er voor gezorgd dat het systeem is ingevoerd?
Wie hebben het systeem tegengewerkt?
Wie vormden de kritieke massa?
Implementatie | Hoe verliep de implementatie?
Technisch
Organisatorisch
Potentie | Wat was de verwachting met betrekking tot het delen van kennis?

Tacit knowledge | Hoe helpt het systeem bij het delen van tacit knowledge?
Ervaring | Wat was de feitelijke ervaring met het delen van kennis?
En tacit knowledge?
Commitment gebruikers | In hoeverre wordt het systeem echt gebruikt?
Succes | In hoeverre is het systeem een succes?

C) ICT-systemen

Rol ICT–gehalte | Was het systeem technisch complex?
Rol | Welke rol kunnen ICT-systemen bij kennismanagement spelen?

Toekomst | Wat is uw toekomstbeeld met dit systeem?
Requirements | Wel k zijn belangrijke eigenschappen voor het ideale systeem?

Afsluiting

Gevaren | Wat zijn de gevaren van kennismanagement (systemen)?

Kennismanagement | Wat moet uw ziekenhuis aan kennismanagement doen?

Bedankt voor uw bijdrage aan dit onderzoek.

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Appendix III: Interview questions
Appendix IV: Approach document

This document has been used in contacting the hospitals in the beginning of the research. Based upon this information the hospitals decided to participate in the research.

Onderzoek kennismanagement bij ziekenhuizen

 Een succesvolle, lerende organisatie

Kennis wordt gezien als de belangrijkste productiefactor van een organisatie. Kennis zoals op papier en in systemen te vinden is wordt vaak aangeduid als expliciete kennis. Een groot gedeelte van kennis in een organisatie is echter niet uitgeschreven, maar bevindt zich in de hoofden van de professionals en wordt wel impliciete kennis genoemd. De aandacht voor beide vormen van kennis in een organisatie wordt aangeduid met de term kennismanagement. Het kan dan gaan om het ontdekken van welke kennis de organisatie bezit, of juist niet bezit en welke kennis dus gehaald of gecreeeerd moet worden; maar ook om hoe deze kennis gedeeld kan worden in de organisatie. In de afgelopen jaren zijn er veel methoden ontwikkeld waarmee organisaties hun kennis kunnen sturen.

De mogelijkheden van kennismanagement worden echter slechts op beperkte schaal toegepast binnen de ziekenhuizen. We weten daarom nog niet zoveel over de succes- en faalfactoren van kennismanagement in deze organisaties. Wat biedt echt toegevoegde waarde aan de professionaal in een zorgorganisatie? Vanuit Adviesbureau Alares onderzoek ik voor de Technische Universiteit Delft in het kader van mijn afstuderen dit onderwerp. Centraal staat daarbij de vraag: “Hoe kunnen ziekenhuizen kennismanagement inzetten ter ondersteuning van het primaire proces?”

Een systeem dat bijvoorbeeld een overzicht geeft van welke kennis de verschillende professionals in een organisatie bezitten, geeft iedereen in de organisatie enkele belangrijke voordelen:

- Direct de juiste persoon vinden, bijvoorbeeld door te zoeken op specifieke expertisegebieden.
- Een overzicht van de aanwezige kennis krijgen, om te kunnen sturen op kennis, bijvoorbeeld het ontwikkelen van nieuwe kennis of het aantrekken van nieuw personeel op bepaalde expertise gebieden.
- Kennisdelen, door met elkaar in contact te komen.

Sommige voordelen zijn van belang voor iedereen in de organisatie, anderen expliciet voor specifieke doelgroepen. Daarom wordt tijdens het onderzoek onderscheid gemaakt tussen verschillen voor managers, professionals en ondersteunend personeel.

Uit een aantal gesprekken met betrokkenen is gebleken dat de behoefte aan een systeem dat de profielen van de gebruikers op een toegankelijke manier opslaat groot is. Echter, ervaring leert dat de implementatie van een nieuw systeem in de staande organisatie vele faalfactoren kent. De invoering van een nieuw systeem zal weloverwogen moeten plaatsvinden. Dit onderzoek zal zich daarom eerst richten op de volgende drie punten.

- De exacte toegevoegde waarde voor alle doelgroepen, zodat zij het systeem ook gaan gebruiken. De gebruikelijke weerstand tegen nieuwe systemen zal overwonnen moeten worden doordat het systeem een duidelijke toegevoegde waarde voor alle gebruikers uitstraalt. Wil een gebruiker niet aan het systeem dan worden belangrijke voordelen mis gelopen. Pas
wanneer alle gebruikers het nut van het systeem in zien en ook managers zullen aansturen op het gebruik van het systeem heeft het systeem een kans van slagen.

- **Aansluiting op de procedures en werkwijzen van de professionals.** Hierbij is het van belang dat het systeem gebruiksvriendelijk is, zo weinig mogelijk uitleg of training vergt en dus zo goed mogelijk aansluit op de huidige werkwijze en procedures van de gebruikers. Hiervoor is het belangrijk bij het ontwerpen van het systeem in te leven in de gebruikers en de gebruikers te betrekken bij het ontwerp.

- **De aansluiting op andere systemen in het ziekenhuis.** Een systeem staat nooit op zich en een groot gedeelte van het succes wordt bepaald door de mogelijkheden samen te werken met andere systemen. Hiermee wordt het gebruik versimpeld en kan de meeste toegevoegde waarde worden geboden. Voorbeelden van systemen waarop aangesloten kan worden zijn de kwaliteitssystemen, de personeelssystemen en communicatiesystemen. Maar ook via website of intranet moet het systeem bereikbaar zijn.

Bij een succesvolle realisatie is niet alleen de techniek, maar de organisatorische inbedding cruciaal. Juist dit is in een organisatie zoals het ziekenhuis een grote uitdaging. Het onderzoek zal daarom eisen opleveren voor een kennismanagementsysteem en hoe dit systeem zal moeten worden ingezet in de organisatie. Sommige eisen kunnen strijdig met elkaar zijn en vormen dilemma’s waarvoor trade-offs moeten plaatsvinden. Gedurende het onderzoek moet blijken of een systeem het ziekenhuis voldoende toegevoegde waarde biedt. De toegevoegde waarde moet in de vorm van een business case voor beslissers inzichtelijk gemaakt kunnen worden.

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