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Global Software Development: A Case Study of Knowledge Management Challenges and Industry Approaches

Mugunthan Dharmadas

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Supervisor: Torgeir Dingsøyr, IDI

Norwegian University of Science and Technology
Department of Computer and Information Science

Problem Description

Global Software Development has been emerging as a necessity and trend in the software industry, but along with its many benefits, several major challenges are present. Poor communication and knowledge sharing are major issues in the software industry, and these challenges are amplified when project members are not co-located.

This thesis should describe challenges and industry approaches in global software development projects, and give a thorough discussion of knowledge management challenges with theoretic grounding.

Assignment given: 15. January 2008
Supervisor: Torgeir Dingsøyr, IDI

Abstract

Recent years, Global Software Development has been pervasive in the field of software development. Research literature describes empirically observed benefits and challenges, but it is descriptive and pragmatic, and offers little theoretic grounding of the findings. The literature recognizes communication and transfer of knowledge as one of the main issues haunting software development, causing poor implementation of projects and poor software quality. This report presents a case study of globally distributed software development, the communicational and knowledge managerial challenges observed, and theoretic reasoning of these.

Mitos' Desert projects have been ongoing for several years with teams in India and Norway. The observed challenges are inadequate information quality when using a middleman in communication; difficulties due to people's preferences on written and oral language use; unbalanced knowledge distribution causing dependencies across sites; lack of informal talks across sites causing coordination issues. Mitos' approaches to cope with these challenges includes extensive visiting; a kit to promote rapid learning for new joiners; intermediaries with cross-cultural experience; quarterly feedback; written summary of meetings to confirm correct interpretation. Overall, Mitos shows maturity in conducting global software development, causing relatively smooth implementation of such projects.

Through the discussion of challenges and solutions, this report shows that a theoretic grounding can contribute to describe *why* challenges occur and solutions work, rather than only describing *what* happens. Also, the study shows the vital role of theories for a better understanding of knowledge managerial aspects of global software development.

Preface

This report is a result of my master thesis at the tenth semester of my master program in computer engineering at Department of Computer and Information Science at Norwegian University of Science and Technology.

The main objective has been to study global software development and its impact on the software industry. I have been free to narrow this report in the direction I find most interesting. Based on my pre-study last semester, research literature, and with advice from my supervisors, I have chosen to focus on communicational and knowledge managerial aspects of global software development.

Writing this thesis has not been an easy task. The thesis is written in co-operation with a company, Mitos (a pseudonym), and they have facilitated the case study and a trip to India in relation with the data collection. Initially, much time (more than two months) was used discussing research questions, and during this time the future of this thesis seemed uncertain. First, my supervisor at NTNU and myself suggested doing a case study for investigating knowledge management issues in global software development. Mitos welcomed it first, but soon they realized that they had other issues related to global software development that was more interesting for them. Therefore we agreed on working with the research questions suggested by Mitos: *Why does Mitos loose some proposals that include an offshoring model for developing the software*? A large amount of time was spent on making this research question interesting for the academia within the field of computer engineering. Halfway in the semester, after several attempts to gather a set of cases and a set of case representatives for data collection, I had to realize that Mitos' assumptions about the possibility to collect data for their research question was very limited in their organization. Finally, the three stakeholders, Mitos, NTNU and I, realized that the best solution was to split into two distinct deliveries:

- Delivery to NTNU: Case study on knowledge managerial challenges in global software development.
- Delivery to Mitos: Systemizing of reasons why offshoring proposals are lost. In addition, they will of course also get the NTNU delivery.

Due to time limit, the Mitos delivery has been postponed a little, so it will be delivered after this thesis report. We agreed that I will work with Mitos' research question, and in return I was granted access to their resources so that I can use some of their offshoring projects as case for my delivery to NTNU. Due to confidentiality the delivery to Mitos will not be discussed any further in this document.

Throughout the case study I have acquired much knowledge about global software development and knowledge management in general, observed the emerging IT-industry in India first hand, and learned how a concrete company handles challenges with managing knowledge in a globally distributed setting. Working with a corporation has been rewarding in the sense that they helped and facilitated trips and gave access to resources, but I also experienced that organizing and conducting a case study can be very time consuming and frustrating some times. For instance, my mailbox holds 235 emails that were used to communicate between Mitos and me, of these 152 emails were sent by me to Mitos for asking questions, informing about status or for coordination purpose.

I will use this opportunity to acknowledge my supervisor, Associate Professor Torgeir Dingsøyr, for guidance, quick response, motivation and feedback throughout the semester. I also want to thank my supervisors at Mitos, who have been helping me conducting the case study and giving guidance and feedback on my work. In addition, I want to acknowledge all the interviewees in India and Norway, and other informants at Mitos for their time and effort. I am also pleased that Mitos financed the India trip and facilitated the case study. Last, I also wish to thank my sister Sharmila Dharmadas for proof reading, and friends and family for motivation and advice.

Trondheim, June 17, 2008

Mugunthan Dharmadas

Contents

List of Figures

List of Tables

Abbreviations

AD	Application Development
AM	Application Maintenance
BPO	Business Process Outsourcing
CMM	Capability Maturity Model
CMMI	Capability Maturity Model Integration
GSD	Global Software Development
GSP	Global Studio Project (a project conducted by Siemens)
GSW	Global Software Work
GUI	Graphical User Interface
ICT	Information and Communications Technology
IMO	India Mitos Office
IS	Information System
IT	Information Technology
ITES	Information Technology Enabled Services
KM	Knowledge Management
KT	Knowledge Transfer
NMO	Norway Mitos Office
NTNU	Norwegian University of Science and Technology
PMA	Post Mortem Analysis
SME	Subject Matter Expert

Glossary

Agile development	software development method that emphasize close customer participation, little documentation and short iterations.
Anthropology	is the study of humanity. Business anthropology seeks to give a holistic perception of human actions in organizations.
Communities of Practice	is a group of people with a shared mental model of their surroundings who interacts informally on a regular basis.
Explicit knowledge	easily expressible knowledge such as mathematic formulas and codified procedures.
Global Software Development	concurrent development of software with globally distributed teams
Hermeneutic circle	a concept stating that human interpretation is achieved by iterating between interpreting the parts and the whole.
Idioculture	a group of people with shared mental model, believes, behaviour, custom and rites. Similar to communities-of-practice.
Nearsourcing	sending outsourced work to foreign neighbouring country.
Offshore outsourcing	sending outsourced work to foreign country, often far away.

Outsourcing	sending work to companies outside the organization.
Post Mortem Analysis	Analysis conducted after a project to assess experience, pros, cons etc.
Shared mental model	having similar understanding of different concepts.
Tacit knowledge	highly personal knowledge that is not easily expressible in words. Intuition and hunches are tacit.

1 Introduction

"Globalization is a fact of life. But I believe we have underestimated its fragility."
– Kofi Annan (7th secretary-general of UN and Nobel Peace Price winner)

Globalization is a fact of life, and the past decades' evolution in the IT-industry clearly states globalization's impact on software development. Since the early years of software development, it has been challenging boundaries in several dimensions: the size and complexity of the software, the increase in the number of developers involved in a development project, the demand for short time-to-market, demand and necessity for innovation, and in the last decades - the immense use of globally distributed teams for implementing software. The latter phenomenon is what is often referred to as *Global Software Development*. The last few years it has been a ubiquitous phenomenon in the IT-industry, visible to all the stakeholders of global software development projects (Damian & Moitra, 2006; Herbsleb & Moitra, 2001; ACM Job Migration Task Force, 2006).

Globalization is not a new trend, but the last decades, with the help of Information and Communications Technologies (ICT), the globalizing process has increased its speed, and it is changing and shaping how we view the world. Marco Polo's voyages to Asia in the 13th century, Christopher Columbus' (re)discovery of America in 1492, the great movement of people across countries are all past or ongoing happenings forming history and making the world smaller, bringing people from different cultures together. Along with development within the travel-industry, technological innovations such as, TV, Internet, chat and email have given people easy access to the whole world with all its diversity, threats, and of course – all its new possibilities and opportunities. In the business world, such opportunities caused by globalization, or any other opportunities, have always been used to accomplish company growth.

American, and later European producers of computer electronics and semiconductors, such as IBM, Philips, AT&T and Hewlett Packard moved some of their production facilities to low-cost countries such as China, Scotland and Singapore already in the 1970s and 1980s (ACM Job Migration Task Force, 2006). In the software industry, the trend of moving some of the

work to low-cost countries started in the 1980s, but it was not until the 1990s the extent of this became great (ACM Job Migration Task Force, 2006). Nowadays, according to Gartner Inc., software-developing companies have to consider going global to be able to cope with the competition: *Globalization is inevitable. IT groups that plan their responses to the challenges raised by this complex issue have a better chance of succeeding in the increasingly competitive environment of software development* (Iyengar, 2004). Going global with the software development is not without challenges, and practitioners and researchers report many challenges when the development work is divided across several countries (Ebert & De Neve, 2001; Sangwan, Bass, Mullick, Paulish, & Kazmeier, 2007; Herbsleb & Moitra, 2001).

The scope of global software development

Table 1-1 shows some statistics and future predictions on the extent of global software development in the world. Sending software work abroad, *offshoring*[1], is shaping the way of doing business in this industry. 40% of Fortune 500 companies are expected to offshore IT work by the end of 2004, and by 2015, 30% of US IT jobs are expected to be offshored (ACM Job Migration Task Force, 2006).

Table 1-1: Statistics on the extent of Global Software Development (ACM Job Migration Task Force, 2006).

Source	Data reported	Statistics
McKinsey & Co, 2003 (as quoted in World Investment Report 2004)	Market value for offshoring of IT services including captive production for multinationals	$32 billion
Gartner, 2004	Fortune 500 companies expected to offshore some IT work by end of 2004	40%
Gartner quoted in McDougall, 2005	Percent of U.S. IT jobs offshored in 2005 and 2015	5% in 2005 30% in 2015

There are many business drivers for software companies to use globally distributed teams for software development. Cost-savings due to lower salary, access to a great pool of skilled people, 24 hours a day development (follow-the-sun development), and closeness to local markets are some of the main drivers for global software development (Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006; Herbsleb & Moitra, 2001; ACM Job Migration Task Force,

[1] Offshoring: a term denoting work sent off shore to other countries. Nowadays the term is used whenever work is sent out of national boundaries, i.e. German work sent to Poland, and not necessarily offshore.

2006). The companies sending their work abroad, the *offshore outsourcers*[2], are often American, West-European or Japanese companies, while the receivers of this work, the suppliers, are often located in Asia or East-Europe (ACM Job Migration Task Force, 2006). Table 1-2 shows what attracts the outsourcers to send their work to different countries. The table shows that India is a principle example of a country with low cost, high capacity and language skills suitable for the outsourcers. The term nearsourcing describes outsourcing to countries nearby, for instance, outsourcing from a US company to a Canadian company, while outsourcing to India or China from the same American company will be referred to as offshoring. The table shows mostly East European countries as nearsourcing countries, in addition to China, which gets much of the Japanese outsourced IT-work (ACM Job Migration Task Force, 2006).

Table 1-2: Countries and their offshoring strategies (ACM Job Migration Task Force, 2006).

Strategy	Principal Examples	Others
Cost and capacity	India, China	Malaysia
Language skills	India, Philippines, Mexico, Costa Rica	South Africa, Tunisia, Morocco, Senegal, Madagascar, Mauritius
Nearsourcing	Canada, Poland, Czech Republic, Hungary, Slovakia	Ukraine, Belarus, Romania, Latvia, China
Special High-End Skills	Israel, Ireland, Australia, United States	India, China, Russia

India is also the primary receiver of software work sent out of Europe, as shown in Figure 1-1. These numbers are estimated by Parker in 2004, and found in (ACM Job Migration Task Force, 2006). India's position as the primary location to receive offshore outsourcing work requires them to produce a tremendous amount of qualified graduates within software and computer engineering. India, with the world's second largest population, has 2 million workers within IT and ITES (Information Technology Enabled Services) (NASSCOM Foundation, 2008). To place this amount in perspective, this number is almost the half of the Norwegian population, and according to ACM Job Migration Task Force (2006) the 20% yearly growth in the number of employees in Indian IT-industry made the *increase* in the

[2] Outsourcing: a term denoting that work is sent out of one organization to another. Example: Company A hires Company B to do their billing or support work.
Offshore outsourcing: a term denoting that the outsourced work is sent to another organization in another country. Thus, offshoring + outsourcing = offshore outsourcing.

period 2005-2006 to be the total amount of IT workers in Israel and Ireland together. Figure 1-2 shows the development in the amount of workers within Indian IT-industry the past decade, which has increased from 0.19 million in 1998 to 2 million employees in 2008, a tenfold growth.

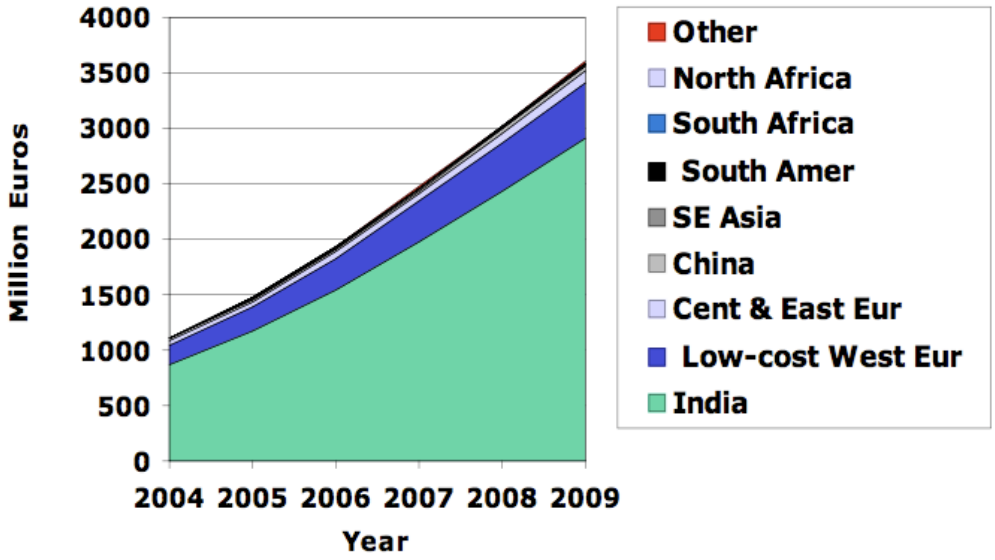

Figure 1-1: European offshore IT-service spending by recipient location. Extracted from (ACM Job Migration Task Force, 2006).

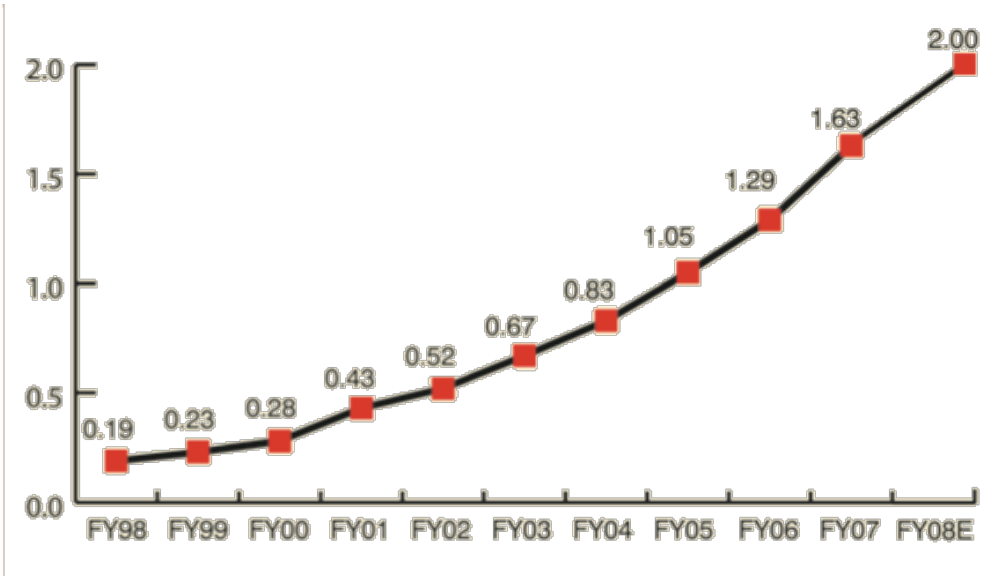

Figure 1-2: Direct employment (in million) in IT and ITES industry. Extracted from (NASSCOM Foundation, 2008).

Challenges in software development
From its early childhood, the software industry has been striving with several problems. David Parnas, one of the early pioneers in the field of software engineering, briefly identify the ever-existing challenges that have been haunting the software industry for the past four decades (Ågerfalk & Fitzgerald, 2006):

- The delivery schedule for the software often slips, and sometimes the software is cancelled due to these slips.
- Poor quality on the software, or it does not solve the users' needs and requirements.
- Software design that cause costly ripple effect for small changes.
- The software is not maintainable with a reasonable amount of time and effort.

According to Parnas, in (Ågerfalk & Fitzgerald, 2006), all these challenges have one main root cause: poor communication – thus, poor sharing of knowledge. He further states that there are three main communicational processes among the stakeholders that cause this situation:

- Poor communication between users and developers.
- Poor communication between architects and developers.
- Poor communication among developers.

During my studies, one of my lecturers, Professor Tor Stålhane, used to say *there is nothing wrong with people's coding skills. That is not what causes projects to break down. The problem is that you developers prefer talking to computers rather than humans.* Although this statement may be a little harsh or exaggerated, his point seems to coincide with Parnas, namely that communication is the main issue causing major challenges in the software industry.

When indulging in global software development the communicational challenges are amplified (Herbsleb & Grinter, 1999b; Ågerfalk & Fitzgerald, 2006; Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006). The physical (geographical), socio-cultural and temporal distance are new dimensions added to the development process, causing the already existing challenges to be magnified (Ågerfalk & Fitzgerald, 2006; Sahay, 2003).

1.1 Defining Global Software Development

Global Software Development (abbreviated to GSD in the rest of the report), is sometimes referred to as Globally Distributed Software Development, and

refers to the process of developing a piece of software with teams located in different places, co-operating to deliver an application according to the clients' requirements. Different researchers define GSD differently. Sangwan, Bass, Mullick, Paulish, & Kazmeier (2007) refer to it as *software development that uses teams from multiple geographical locations*. This definition does not clearly state that the teams need to be located in different countries, only that they need to be geographically dispersed. A project with teams located different places within the same country is referred to as GSD by these authors.

The following of this discussion of defining GSD is to some extent brought directly from my pre-study, (Dharmadas, 2007).

Domestic teams, as long as they are geographically dispersed, will observe much of the same issues as globally distributed teams, but some type of challenges, such as socio-cultural issues will have greater impact on the latter. Organizational culture could be differently accross teams within the same country, but when going global, both organizational and national culture may be differing. In addition, temporal and geograhical distance often naturally increases when moving accross national boundaries. Although a short distance on 30 meters between project members will have similar effect as kilomteters (Allen, 1977), Dharmadas (2007) argues that due to the major impact of great distance and cultural variety when the teams are residing in different countries, it is of great importance to state if one consider teams accross different nations or not. Similarly, the majority part of the recent literature (as far as I have read) on GSD seems to discuss or describe settings where the teams reside in different countries. Thus, GSD should at least be defined as a phenomenon where different teams, residing different countries, contribute and co-operate concurrently to develop a piece of software. Sahay (2003) defines Global Software Work (GSW) as *software work undertaken at geographically separated locations across national boundaries in a coordinated fashion involving real time and asynchronous interaction.* There are no principal differences between GSW and GSD, other than that the term *work* is more open than *development*, but it has no significant effect for my purpose. Thus, the definition of GSD in this report will be similar to that of GSW:

> *Global Software Development is software development undertaken at geographically separated locations across national boundaries in a coordinated fashion involving real time and asynchronous interaction.*

1.2 Problem Definition

The introductory description of GSD and IT-industry described how poor communication is a major issue for the industry, and that its importance for a successful development project is amplified when the project members are not co-located. Here we are at the foundation for this thesis, namely the impact global software development has for communication and knowledge sharing in development projects. This thesis draws on the author's own work *Global Software Development: Theoretic Grounding of Empirically Observed Challenges and Industry Solutions Related to Communication and Knowledge Management,* from the pre-study last semester (Dharmadas, 2007). During this work, I studied a great amount of literature regarding these issues, and focused my work on analysing a case study from Siemens with respect to communicational and knowledge managerial challenges. While the data collection at Siemens was done and reported by others (Sangwan, Bass, Mullick, Paulish, & Kazmeier, 2007; Mullick, et al., 2006), I have conducted the case study myself for this thesis.

The literature on software practice lacks foundation on scientific theories; it is more descriptive and is often based on experts' claims (Robinson, Segal, & Sharp, 2007). Within case studies on GSD there is also a need to have better foundation on scientific theories (Damian & Moitra, 2006).

Informal talks is one of the major strategies in agile methodologies to overcome some of the challenges in traditional development processes (Chau, Maurer, & Melnik, 2003). The importance of informal talk in an organization has been renowned by researchers in other fields (Orr, 1990; Fine, 1988), and also within the field of information systems (Herbsleb & Grinter, 1999b; Herbsleb & Moitra, 2001; Desouza, Awazu, & Baloh, 2006). In the field of software engineering focus has been given to explicit and formal coordination mechanisms, not to the informal way of coordinating (Herbsleb & Grinter, 1999b).

In their position paper, Dingsøyr, Rolland, & Jaccheri (2004) propose further research on knowledge management aspects of global software development. They predict that in a distributed setting with tremendous physical distances, the lack of informal interaction may cause focus on other substitutional ways of communication. Hence, more research with focus on knowledge management in a global software development setting is suggested by the authors.

The above description suggests focus on communication, thus on knowledge sharing, because of its importance on software development; foundation on scientific theories; and a focus on knowledge management and informal talks in a GSD setting. My research questions will take these appeals to account:

> *What are the knowledge managerial challenges in global software development, and what approaches are implemented by the industry to overcome these? How can these challenges and solutions fit into existing knowledge management theories and concepts, and what is the role of informal communication in a global setting?*

This report aims describing global software development and its challenges. The approach is to look in to a specific case study, and analyse the findings regarding communication and knowledge sharing, with foundation on empirical studies within the field, and theories from the field of knowledge management and organizational studies. The field of business anthropology has been doing ethnographic studies on corporations for decades, thus being a mature field in such regards. Bate (1997) argues that the field of organizational studies strives giving a complete picture of organizations due to their lack of *historical, contextual* and *processual* focus. He further argues that anthropological methods such as etnography offer a more holistic presentation and present historic and social context, in addition to see behind the fascade looking for informal behaviour. I have chosen to include some business anthropological works (Fine, 1988; Linstead, 1985; Orr, 1990), and used them as examples in the analysis. Also in this report, much *context* information is given, in addition to some *historic* explanation of findings, and the focus of this thesis lies in informal communication, which is *processual*.

1.3 Limitations and Restrictions

The case study is done within the timeslot of a semester (5 months), and when considering a significant amount of time is used to organize the work, discuss research questions and other relevant work, the study itself will be rather small. Additionally, several months were used in uncertainty due to the lengthy negotiation process between the case organization, my supervisor at NTNU and myself. Thus, the data collection phase, analysis phase and writing of the report had to be done during less than three months, which gives implications on the ability to give a deep, holistic and thoroughly presentation of a the case study.

The case study covers only challenges related to communication and knowledge management, but in a broad view, thus including challenges which

otherwise would not be characterized as not related to these concepts. Other challenges that have no links with the transfer of knowledge are not dealt with. There are other interesting areas of study within GSD: open source development, which is often globally distributed; agile development in a GSD setting; technologies and tools for supporting cross-site communication and informal talks in a distributed setting. But due to time limit, these areas are not discussed.

The study is unbalanced in its set of informants with majority of the informants being Indians; therefore this study is a description of global software development seen from India. The points of view from Norway have got less importance.

There exists a great amount of knowledge management concepts, theories and frameworks. For the purpose of this study only a few of these are chosen, so the reader should note that there are other theories that may be complementary and give other points of view.

The software industry has to relate to several problems when indulging in GSD, thus new tactics and practices to overcome these issues are quickly implemented (Carmel & Agarwal, 2001). This implies that challenges and best-practices presented in the literature may be outdated or less relevant nowadays. In this report, this is accounted for by mainly choosing the most recent articles, less than ten years old and preferably as new as possible, as the theoretic basis. Of course, there are some highly influential older papers, and these are used, but for the empirical works described in this report, the most recent literature is chosen to ensure that the current real world situation is correctly presented.

1.4 Report Outline

This report has three main sections. The first three chapters serves as background information, and contextualization, and describes theories to be used later. Chapter four is the next section describing research design, method and conduct. Chapter five is the last main section describing the whole case study, giving its results and analysis. In the following, the report outline is described in more detail.

This chapter gave an introduction to global software development, its impact on global business and a short historic view. Further it defined the term *global*

software development, defined research questions, and described the limitations and restrictions of this report.

Chapter 2 describes global software development more thoroughly, stating the benefits of GSD, organizational models used when conducting GSD, and challenges related to working with globally distributed teams. This chapter, along with the introductory chapter, builds context for my research, and gives background information about GSD outside the case boundaries, thus helping the reader to get a more holistic picture of the findings of the case study.

Chapter 3 describes the main knowledge management concepts used in this study. It includes defining knowledge, knowledge management, describing different schools of knowledge management, categorization of knowledge as tacit and explicit, describing how knowledge is created and propagates through organizations, and last it describes the concept of communities-of-practice.

Chapter 4 describes research method. It includes a description of the data collection methods, a narrative of the research conduct, description of how the cases were chosen, and an assessment of the quality of the research according to known principles. This chapter is usually placed earlier in other literature, but due to its close relation to the chapter that presents the results from the case study, they are placed next to each other.

Chapter 5 describes all aspects of the case study. It gives information about the case organization, the cases, and observations from the visit in India. A structured presentation of the results and analysis of the findings are also given. Last in this chapter the validity and generalizability of the findings are discussed.

Chapter 6 concludes the work, while *chapter 7* states possible future work.

The appendices include interview guide, transcripts, and analysis matrixes and affinity diagram.

2 Global Software Development

```
main() {
      printf("hello, world");
}
```

- Brian Kernighan's example code in "Programming in C: A Tutorial" (1974)

In this chapter global software development (GSD) will be described in detail. The business drivers making GSD an emerging trend in the IT-industry, the challenges experienced by the practitioners and their solutions are main contents of this chapter. This chapter thus serves as context for the case study in chapter 5.

Some of the material in this chapter is reproduced directly from my pre-study (Dharmadas, 2007) last semester, but it is modified with more up-to-date information. Chapter 2.1 is rewritten with several new sources of information and only some of the information is brought from the pre-study, chapter 2.2 is a direct reproduction, while chapter 2.3 is modified with including more empiric research literature.

The introduction chapter gave an overview of GSD and defined it as *software development undertaken at geographically separated locations across national boundaries in a coordinated fashion involving real time and asynchronous interaction.* With the definition clear, let us first investigate what motivates GSD.

2.1 Benefits of GSD

The research literature points out several factors motivating companies to indulge in global software development. Although challenges regarding geographical distance, sociocultural diversity and temporal distance, cause difficulties and challenges the potential benefits of GSD, the pros are great enough to cope with many of the challenges. What are the critical success factors affecting an ERP system implementation?

Several sources (Herbsleb & Moitra, 2001; Ebert & De Neve, 2001) identify similar drivers for the extensive use of development teams located in several countries. These drivers are summarized below:

- Reduced development costs due to low wages.
- "Follow-the-sun" development due to different time zones.
- Scarcity on developers onsite, great pool of them at low-cost countries.
- Closeness to new markets.
- Technological evolution.
- Acquisitions and mergers with foreign companies.

More recent literature (Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006; Ågerfalk & Fitzgerald, 2006) show slightly different set of business drivers for GSD, or in their own words, *potential benefits* of GSD:

- Reduced development costs due to low wages.
- Leveraging time-zone effectiveness.
- Cross-site modularization of development work.
- Access to large skilled labour pool.
- Innovation and shared best practice.
- Closer proximity to market and customer.

The first four business drivers in the first list are similar to those in the second list, but technological evolution and acquisitions are removed on the second list. The term *benefit* makes technological evolution not a possible benefit, because it is rather an enabler for GSD, and not a benefit from GSD. Acquisitions are also an enabler for GSD, because they cause companies to co-operate with other companies abroad, but GSD makes also acquisitions and mergers more flexible to capitalize when there occurs any opportunities (Herbsleb & Moitra, 2001). Thus, the reason why technological evolution is not present in the second list is clear, while the removal of acquisitions is more unclear, but it may just be that it is not as important nowadays. For this report, it is not of great value to discuss why acquisitions are not present in the second list, and therefore it is left undiscussed.

Two new potential benefits are added in the second list; *cross-site modularization of development work* – stating that GSD cause architects to design well-defined modules with less interdependencies, thus making it easy to work in parallel; *innovation and shared best practice* – stating that when people from different cultures and locations interacts, all individuals can learn new way of thinking, laying foundation for innovation.

While the majority of the articles I have read about GSD only give a short description of its benefits, and almost take them for granted, Conchúir, Holmström, Ågerfalk, & Fitzgerald (2006) have done an empirical study to try to verify the truth in the acclaimed benefits of GSD. In the description of the benefits of GSD, I will rely heavily on this article, because it is one of few articles describing the benefits critically. Hence, a short description of this

article is needed: the authors have conducted three case studies at Intel, Hewlett Packard and Fidelity Investsment, all actively practicing GSD. The data collection was conducted among individuals in all types of roles and only at the companies' Irish offices. Throughout their article they discuss each of the six assumed benefits of GSD and try to strengthen them or criticize them with their findings.

In the following of this subchapter, I will discuss each of the six potential benefits with data from several sources, but inherently use Conchúir, Holmström, Ågerfalk, & Fitzgerald (2006) as the source for discussing if the *potential* benefits are real benefits or not.

2.1.1 Reduced Development Costs

Companies in western countries show a great effort in renewing their portfolio of information technology systems, and this gives the software developing companies many new contracts. Western countries also experience a shortage of qualified software developers, so they look outside national borders to fulfil their need for new employees (Herbsleb & Moitra, 2001; ACM Job Migration Task Force, 2006). Low-cost countries like India, China, Brazil and countries in Eastern Europe have a vast pool of software developers, and because they are less expensive than western employees it is suitable for western countries to use these abroad resources to develop software (ACM Job Migration Task Force, 2006). The wages differ heavily: annual salary for an Indian software developer can be a quarter of what it is in Ireland, which in turn is half of the American developers' salary(Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006). This makes an Indian developer 8 times cheaper than an American one.

Cost-savings are therefore a potential great benefit of GSD, but globally distributed teams require some new roles, such as intermediaries to ease the cross-site communication. In addition, the team members do not know each other, causing a need to visit each other to build trust and relationships across national boundaries. These two factors add costs that are not easy to estimate prior to the project, and they cause additional costs that are often not accounted for when considering this benefit (Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006).

2.1.2 Leveraging time-zone effectiveness

"Follow-the-sun" development, or "round-the-clock" development, is coordinated development with sites in different time zones that hand over work to each other so development can be conducted almost 24 hours a day. The positive side of "follow-the-sun" development is the possibility to improve the time-to-market (Ågerfalk & Fitzgerald, 2006). This can be very useful if it is strategically important for the customer to be the first in market with the software, i.e. be the first in a country to deliver Internet banking service.

Case study at three anonymous companies showed that follow-the-sun development gives communicational overhead because of the need to explain what has been done on each hand-over of work to a new site, so the total amount of developer-hours usually will raise (Ramesh, Cao, Mohan, & Xu, 2006). Similarly, the case study at HP, Intel and Fidelity Investment, show that follow-the-sun development was more a burden than a benefit, and in HP's case they actually tried to increase the overlap time to counteract the time differences. This study also revealed that the companies thought that follow-the-sun approach did not suit all development works, only in some cases such as testing and defect resolution. *Delayed responses and the fact that all development phases are not suitable for follow-the-sun development make this hard to achieve, and is ultimately unattractive approach to GSD* (Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006).

2.1.3 Cross-site Modularization of Development Work

Low coupling, high cohesion (David Parnas) has been a mantra and best practice for years and decades when designing the system architecture. By having system architecture with low coupling across different modules, and high cohesion of similar functions within one module, the different modules are less dependent on each other, and such architecture is also better for modifiability. The increased independence across modules makes it easier to develop in parallel, and in a GSD setting, the software architects are more or less forced to make an architecture that makes it possible to work on different modules without too much cross-site communication. In this way the software design may be better, at the same time as working in parallel can cause faster development (Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006).

Although it seems like a win-win situation, less dependent modules makes it possible to work more or less independent from other sites developing other

modules, but over time this practice can cause difficulties integrating the different modules. Also, if little cross-site communication is needed, then there are fewer possibilities to build long-term relationships across teams residing different countries (Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006).

2.1.4 Access to Large Skilled Labour Pool

As mentioned in the introduction chapter, many countries with low wages have a vast amount of skilled software developers. This report focuses much on India, so I will just use numbers from the Indian IT industry. According to the National Association of Software and Services Companies (NASSCOM) in India, the Indian IT and ITES industry has ten-folded its number of employees the last decade, from 190 000 employees in FY98 to a predicted 2 million by the end of FY08 (NASSCOM Foundation, 2008). The mix of sexes in the Indian IT sector seems to converge to a 50/50 situation. It is expected that 45% of the employees within IT/ITES will be women in 2010; currently the number is 30% (NASSCOM Foundation, 2008).

Such numbers are great compared to other countries, giving foreign companies possibilities to access skilled developers in India. Until 2004 India produced more IT graduates than needed, but now there is a shortage of workers even in India (NASSCOM Foundation, 2008). Although India tries to cope with this shortage by creating new institutions for studying computer science, the rapid increase in the market's demand for skilled people, increases the wages causing people to change employer often in search for better conditions. In Bangalore, Intel, HP and Fidelity Investment reported very high attrition levels (Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006). The same companies state that the cultural differences exacerbate the already existing challenges in software development. Hence, though GSD gives access to a large pool of skilled workers worldwide, high turn over in staff, and cultural diversity are the challenging backside of this benefit.

2.1.5 Innovation and Shared Best Practice

Alcatel, a global telecommunications supplier with R&D offices situated in more than 15 development centres in four continents, has been conducting GSD projects for years. Their experiences show that GSD has a tremendous positive effect on innovation (Ebert & De Neve, 2001). These authors describe this briefly:

> *Engineers with all types of cultural backgrounds actively participate to continuously improve the product, innovate new products, and make process more effective. Achievements are substantial if engineers of entirely different educations and cultures try to solve problems. Best practises can be shared, (...).*(p. 68).

Contradictory, Conchúir, Holmström, Ågerfalk, & Fitzgerald (2006) report that the companies in their study show that resources, other than those in managerial roles, seldom interact with their remote colleagues. Hence, they question the ability to innovate through interaction of people with different backgrounds, when they do not meet each other. Their research also show that some employees in the western offices underestimate the knowledge of their counterparts in low-wage countries, implying that the best-practices from such countries are not valued highly among the western employees. Though their own findings state that innovation and sharing best practices are not as easy to accomplish, the authors remind that other literature reveals that western companies get more focused on Capability Maturity Model[3] (CMM) levels and learn from offshore partner because they have often higher CMM level. According to NASSCOM Foundation (2008) 30% of the companies worldwide in level 5, the highest level, on Capability Maturity Model Integration[4] (CMMI), are Indian IT/ITES companies.

2.1.6 Closer Proximity to Market and Customer

Presence in other countries implies presence in new potential markets, and when competition increases it is important for companies to search for new markets. By using GSD, companies also get more knowledge of the foreign market, thus being able to better make products suitable for the new market (Herbsleb & Moitra, 2001; ACM Job Migration Task Force, 2006).

On the other hand, Conchúir, Holmström, Ågerfalk, & Fitzgerald (2006) observed that this presence in local markets should be weighed against the disadvantages of having socio-cultural problems due to the diversity of cultures in the organization.

[3] Capability Maturity Model (CMM): similar to CMMI. CMM was the predecessor of CMMI.
[4] Capability Maturity Model Integration (CMMI): is a process improvement maturity model for product and service development. It consists of best practices for the product lifecycle (CMMI Product Team, 2006).

2.2 Organizational Model for Conducting GSD Projects

Now, let us study the different ways companies organize and structure their global software development intensives.

Sahay (2003) argues that global software work can be undertaken through outsourcing, alliances or subsidiary arrangements. Carmel and Agarwal (2001) identify five structural arrangements for global software development. Three of these are intra-firm, namely foreign subsidiary, foreign acquisition and offshore development centre. The two other arrangements are external to the firm, and include joint venture (or alliance with foreign firm), and foreign outsourcing. The three intra-firm arrangements have more in common than the two inter-firm arrangements in the sense that they are all within same organization, thus having similar organizational culture and sub-cultures. Therefore I group the tree intra-firm arrangements within what Sahay (2003) labels subsidiary arrangements. Summarizing this, we get three types of organizational models for global software development:

- Intra-organizational teams located in different physical sites (subsidiary arrangements).
- Inter-organizational teams where the organizations collaborates (alliances and joint ventures).
- Outsourcing – one organization is the outsourcer of the development work while the other, supplier, does the outsourced work.

The type of organizational model or structural arrangement used is of great importance for the ability to communicate easily. Outsourcing is the most complex of these models because of the difference in the way of interpreting each other. The cultural distance is greater for outsourcing than for the two other organizational models because both organizational culture and national culture differs (Krishna, Sahay, & Walsham, 2004; Carmel & Agarwal, 2001). Alliances suffer from comparable distance, but they are often long term, so alliance partners learn to understand each other over time.

2.3 Challenges Observed in GSD

When talking about GSD, both the author of this report and several authors of the major influencing papers in this field, tend to be negative and focus on the problems and challenges (Ågerfalk & Fitzgerald, 2006). This can be justified because the major challenges within software engineering get more

complicated in a global context, and therefore need to be addressed. I will argue for at least one more positive effect than those business related drivers presented in chapter 2.1: Having the possibility to travel to the remote sites, as a part of your job, is a way of learning other cultures and exploring the world. This is a point not often mentioned in the GSD literature, but intuitively and according to (Trunk, 2007) the new generation of young adults see travelling as an important part of their lives. This generation, often named "generation Y" (Trunk, 2007), is in these days in their early years of work life, and GSD may be a way of fulfilling one of their soft requirements for an employer, hence GSD offers both personal development and business advantages.

Now, let us study challenges experienced by practitioners of GSD. Herbsleb and Moitra (2001) group the challenges, caused by the distance between project members, into six groups. These are summarized in Table 2-1.

Table 2-1: Major challenges in GSD (Herbsleb & Moitra, 2001)

Issue	Explanation
Strategic issues	Work dividing, resource management, fear for losing job.
Cultural issues	Different way of seeing the world can cause misunderstandings and conflict
Inadequate communication	Especially the informal "corridor talk" is not possible, and many issues may be not dealt with as early as in co-located projects.
Knowledge management	Up to date documentation and status tracking is even more important in GSD.
Project and process management issues	Synchronizing issues among sites is important to deal with so misunderstandings do not evolve
Technical issues	Network need to be stable and the formats and versions of tools used should be common.

Strategic issues

This group of issues deals with the work breakdown structure and the allocation of resources to these work packages. The development project has to be decomposed to smaller work packages according to the resources available at each site and their expertise, the amount of inter-team communication needed, the infrastructure and other similar circumstances (Sangwan et al., 2007). From Siemens, Mullick et al. (2006) describe such temporal and modular interdependencies. The management also has to deal with resistance within own organization because the employees fear their job (Herbsleb & Moitra, 2001; Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006). Motorola reports scepticism towards offshore site: *management team*

had a genuine concern that the international engineering teams would not be able to produce as needed (Battin, Crocker, Kreidler, & Subramanian, 2001, p. 75).

Cultural issues

The national cultural differences between countries taking part in global software development can be significant, and cause misunderstandings and conflicts. These issues include misunderstandings caused by different mother tongues, different attitudes towards hierarchy and authorities, different sense of time and deadlines and so forth (Herbsleb & Moitra, 2001; Krishna, Sahay, & Walsham, 2004). Siemens report that *lack of contextual information causes misunderstandings and confusion* (Mullick, et al., 2006), denoting difficulties when not aware of the other site's cultural norms and communication styles. Also, different organizational cultures introduce different work practices and norms, i.e. different development process across sites cause coordination difficulties (Battin, Crocker, Kreidler, & Subramanian, 2001).

Inadequate communication

The physical distance causes less communication than often wanted in software development. Informal talk is far less usual in GSD than in co-located projects, and this causes slow information flow between teams (Mullick, et al., 2006). When a requirement change or a misconception is cleared, the time for the information to propagate to other teams is substantially more in GSD (Herbsleb & Moitra, 2001). Unclear development process communication across sites, and inconsistent communication from different intermediaries causing confusion are other reported issues (Mullick, et al., 2006).

Knowledge management

Because the teams reside different physical locations, the need to state an exact framework that need to be followed by all parts is even more important. The documentations need to be updated and followed. Issues belonging to this group concern the poor documentation quality, the need to prevent ambiguity, and spreading of new information to all parts within a short time (Herbsleb & Moitra, 2001). Formal documents written at one site are not intuitive and easy to understand at another site, and overall consistent understanding across sites is not easy to accomplish (Mullick, et al., 2006). Motorola reports difficulties to teach domain knowledge to remote sites when it is physical distance to those possessing such knowledge (Battin, Crocker, Kreidler, & Subramanian, 2001).

Project and process management issues
The concurrent development and interdependencies among the remote teams cause synchronizing issues. Volatile requirements, changing specifications and changing design can cause substantial synchronizing effort for the project management team (Herbsleb & Moitra, 2001).

Technical issues
Issues concerning network bandwidth, version control and configuration management belongs to this group of issues. Often the use of incompatible tools and data formats also cause substantial rework and delays (Herbsleb & Moitra, 2001). Other studies report that content management of repository was difficult due to local mirroring of the central repository (Mullick, et al., 2006), and ad-hoc re-planning and change of the content of modules caused difficulties executing integration tests (Mullick, et al., 2006; Battin, Crocker, Kreidler, & Subramanian, 2001).

Conchúir, Holmström, Ågerfalk, & Fitzgerald (2006) use another grouping scheme for the challenges: challenges due to temporal distance, geographical distance and cultural background. Many of these issues are also experienced in my case study in chapter 5, and they will be discussed in detail in the case analysis. They give a very compact description of the major challenges, so I present it below entirely in their own words:

- *Temporal distance reduces overlapping hours of possible collaboration and can introduce a delay in feedback from colleagues. The use of asynchronous communication tools may not adeqately handle ambiguities, and can increase the risk of misunderstandings.*
- *Geographical distance reduces informal communication. This can hinder the development of a sense of 'teamness', the establishment of trust and the spread of important information about the project.*
- *Cultural background can greatly affect how developers interpret and respond to a certain situation . Language difficulties often introduce misunderstandings thus hampering effective communication and coordaination in GSD.*

3 Knowledge Management

"The only source of knowledge is experience"
- Albert Einstein (Physicist and Nobel Physics Prize winner)

In this chapter a number of scientific theories around the concept of knowledge and knowledge management will be presented. These theories have their foundation in fields like organizational theory and management studies. The theories presented here will be used when analysing the case study presented in chapter 5. A notable difference between the present chapter and the other ones is that this chapter is purely based on papers from other fields than software engineering or information systems. Also, this chapter is mainly a direct reproduction of the pre study (Dharmadas, 2007) written last semester, but it is modified to suit this thesis, and some new concepts are included.

3.1 Explaining Knowledge

Before going on discussing issues about knowledge, there is a need to discuss this somewhat vague term. Alavi & Leidner (2001) review different knowledge perspectives and their implications for knowledge management. Their summary of these perspectives is presented in a table, which is reproduced in Table 3-1. The *object* and *access to information* perspectives treat knowledge as something tangible and objective, while the other perspectives have a dimension of personal interpretation on knowledge. They emphasize that knowledge is inherently personal. Walsham (2001) argues that the simple view of knowledge as a *commodity or a quantifiable tradable asset* is not satisfactory. He chooses a more human-centred view of knowledge with focus on what is in people's minds, the presentation of this to others, and how others interpret the presented information. He also gives empirical examples of how information systems made to aid knowledge sharing in corporations fail because of their treatment of knowledge as a commodity. Knowledge is dependent on both the promoter and the receiver of information according to Walsham (2001). Based on this discussion, this report views knowledge as much more complex than a quantifiable asset, and its close correlation with

the personal interpretation is recognized. The next subchapter presents a well-known taxonomy that supports this view.

Table 3-1: Knowledge Perspectives and Their Implications. Extracted from (Alavi & Leidner, 2001, p. 111)

Perspective	Explanation	Implications for Knowledge Management (KM)
Knowledge vis-à-vis data and information	Data is facts, raw numbers. Information is processed/interpreted data. Knowledge is personalized information.	KM focuses on exposing individuals to potentially useful information and facilitating assimilation of information.
State of mind	Knowledge is the state of knowing and understanding	KM involves enhancing individual's learning and understanding through provision of information.
Object	Knowledge is an object to be stored and manipulated	Key KM issue is building and managing knowledge stocks.
Process	Knowledge is a process of applying expertise.	KM focus is on knowledge flows and the process of creation, sharing and distributing knowledge.
Access to information	Knowledge is a condition of access to information	KM focus is organized access to and retrieval of content
Capability	Knowledge is the potential to influence action.	KM is about building core competencies and understanding strategic know-how.

3.2 Explicit and Tacit Knowledge

We can know more than we can tell, the philosopher Michael Polanyi stated in his famous work, *The Tacit Dimension* (1967). Here he introduced the notion of tacit and explicit knowledge that has been widely used in the field of management studies (Walsham, 2001). Nonaka and Takeuchi (1998) explain these terms very clearly as follows:

- *Explicit knowledge can be expressed in words and numbers, and easily communicated and shared in the form of hard data, scientific formulae, codified procedures or universal principles* (p. 215).
- Tacit knowledge is *something not easily visible and expressible. Tacit knowledge is highly personal and hard to formalize, making it difficult to communicate to others or share with others. Subjective insights, intuitions and hunches fall into this category of knowledge. Furthermore, tacit knowledge is deeply rooted in an individual's action and experience, as well as in the ideals, values or emotions he or she embraces* (p. 215).

A comprehensible example of these two aspects of knowledge, especially for those with driver licence, is the difference of *reading* how to drive a car in contrast to *practicing* driving. The former is explicit knowledge and the reader can get a good grasp on how to handle the clutch pedal and gearbox; the latter, which is tacit knowledge, offers a deeply rooted and intuitive impression of how these components work together.

Walsham (2001), Nonaka and Takeuchi (1998), and Alavi and Leidner (2001) also explain that Polanyi links explicit knowledge with tacit knowledge by declaring that no explicit knowledge is independent from the individual's tacit knowledge, because everyone will be using his or her tacit knowledge to interpret the explicit knowledge. The driver license example can be used to illustrate this by thinking of a person who has tried driving before ever reading about how to handle the clutch and gearbox. When reading, the person will easily associate what he reads with his trial driving, and link the explicit knowledge from the book with his experience.

Earlier in this chapter I argued that knowledge is not merely a tangible commodity, but that it has a dimension of human interpretation. The recognition of knowledge as both tacit and explicit supports this view; the explicit knowledge, which is tangible, can only be understood by the use of the individual's tacit knowledge to interpret. *Tacit knowledge forms the background necessary for assigning the structure to develop and interpret explicit knowledge* (Alavi and Leidner, 2001, p. 112).

3.3 Knowledge Creation

In addition to working with explicit and tacit knowledge, Nonaka (1994) has developed an organizational knowledge creation theory. The basic concepts in the theory are the two dimensions of knowledge creation: *epistemological* and *ontological* dimension, and the four interactions between tacit and explicit knowledge that creates knowledge: *socialization*, *externalization*, *combination* and *internalization* (Nonaka, 1994; Nonaka and Takeuchi, 1998). These concepts are closely related to the two dimensions of knowledge: tacit and explicit knowledge.

3.3.1 The Two Dimensions of Knowledge Creation

The epistemological dimension is the one dividing knowledge into tacit and explicit, at the same time as relating these two together as described in the previous subchapter.

The ontological dimension is *the level of social interaction* (Nonaka, 1994). The knowledge is created by individuals, not by organizations, but by focusing on enabling conditions for knowledge sharing, the individually created knowledge may propagate to larger groups, departments, organizational, and even become inter-organizational knowledge.

3.3.2 Knowledge Conversion

Knowledge creation is defined as: *Human knowledge is created and expanded through social interaction between tacit knowledge and explicit knowledge* (Nonaka and Takeuchi, 1998, p. 219). An important part of Nonaka's (1994) knowledge creating theory involves the four knowledge creational modes, socialization, externalization, combination, and internalization. Figure 3-1 illustrates these modes, and each of them is explained in detail below.

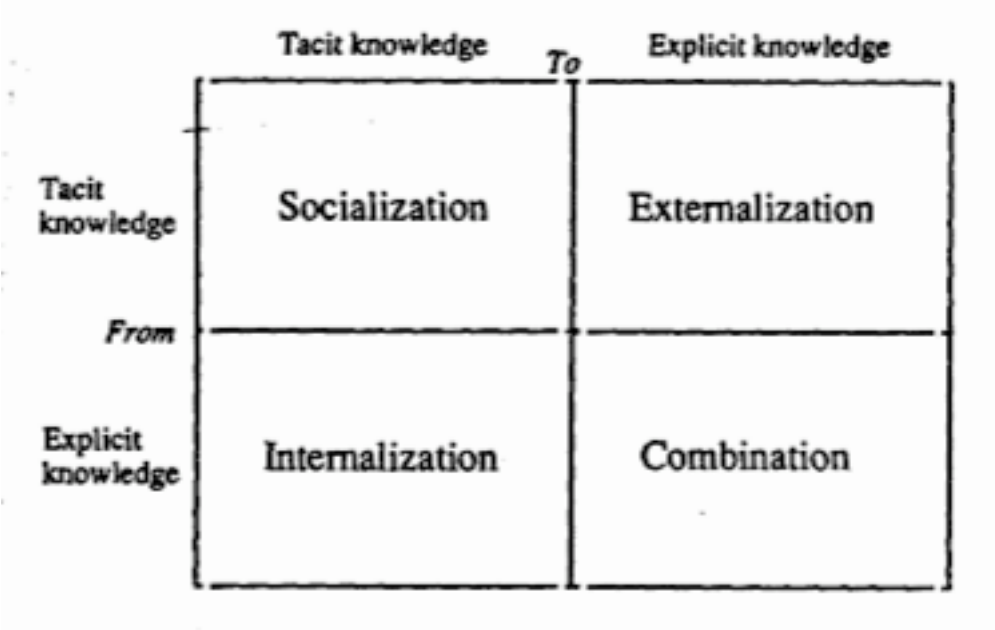

Figure 3-1: Knowledge conversion modes. Extracted from (Nonaka, 1994).

Socialization: tacit to tacit

The socialization process involves individuals sharing their tacit knowledge. This can for instance be sharing of experience. Nonaka and Takeuchi (1998) explain that *without some form of shared experience, it is extremely difficult for one person to project himself into another individual's thinking process* (p. 220).

From our daily life we know the phrase "girls, you can't live with them, you can't live without them" which refers to boys having problems dealing with girls because they simply do not understand their way of thinking. This can be an instance of two groups with different experience, which is not adequately shared, causing difficulties in the socialization process. A better example may be a boy who from his early childhood have been fascinated by cars and therefore paid great attention to how his mother drives her car. He will over time have acquired significant knowledge about car driving due to the socialization process with his mother, which may have happened without any verbal conversations.

Externalization: tacit to explicit

The externalization process involves making the internal tacit knowledge more explicit. Often the tacit knowledge is hard to express in a way that is easily understandable to others, and therefore metaphors and analogies are often used in the externalization process (Nonaka and Takeuchi, 1998).

The driving licence example can illustrate this by for instance the use of the analogy of a pregnant woman when using the expression "pregnant turn". Some driving instructors in Norway use this expression to teach their students to not make a narrow turn in roundabouts, but rather take a large circular turn. The "pregnant turn" expression reminds the student of a large, circular pregnant abdomen.

Combination: explicit to explicit

The combination process involves combining different explicit knowledge to create new knowledge. *Reconfiguration of existing information through sorting, adding, combining and categorising of explicit knowledge (...) can lead to new knowledge* (Nonaka and Takeuchi, 1998, p. 222).

An example of the process of combination is what I will do in chapter 5, where I discuss the findings from a case study with use of the knowledge management theory from current chapter. I combine the explicit knowledge

about knowledge management and the explicit knowledge about the challenges and solutions found at case organization to create new knowledge about how to overcome knowledge management challenges.

Internalization: explicit to tacit

The internalization process involves digesting the explicit knowledge into the *individuals' tacit knowledge bases in the form of shared mental models, or technical know-how* (Nonaka and Takeuchi, 1998, p. 222). Often, this is done by learning while working, but it can also be possible to internalize knowledge just by reading if the reading triggers other experience and the reader really understands it, it may become a part of his tacit knowledge.

An example of internalization process can be found in the greatly cited work of Orr (1990), where he studies copy machine technicians' work. He observed that the technicians had a vast amount of tacit knowledge concerning error detection and solution discovering. The technicians internalize while working: they learn and build up a base of tacit knowledge, which comes in hand when diagnosing the machines. The management did never recognize this tacit knowledge because they never acknowledged the internalization process; rather their perception of the technicians' work was that it was not a knowledge intensive work. According to the management, the technicians could just follow a manual for solving problems.

3.3.3 Knowledge Creation Spiral

Now, I have discussed the two dimensions of knowledge creation and the knowledge creation modes that essentially create the knowledge. To place all these concepts into a system that explains the organizational knowledge creation, Nonaka (1994) and Nonaka and Takeuchi (1998) present the spiral of organizational knowledge creation shown in Figure 3-2. The x-axis is the ontological dimension, in other words, the granularity of the unit holding the knowledge. Y-axis is the epistemological dimension, in other words, tacit and explicit knowledge.

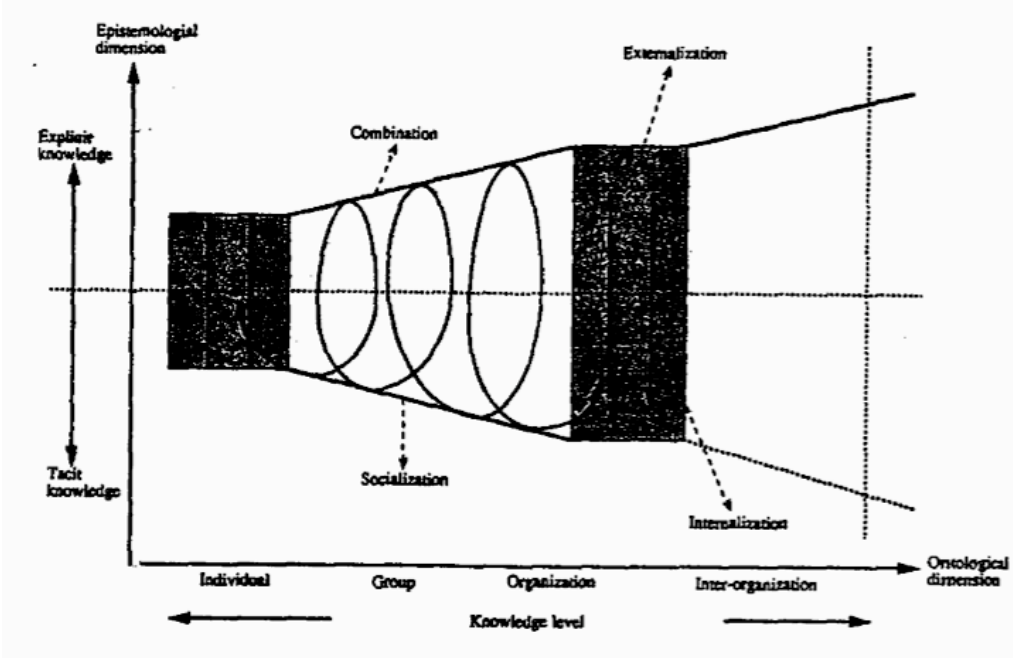

Figure 3-2: Organizational knowledge creation spiral. Extracted from (Nonaka, 1994).

Organizational knowledge creation, as distinct from individual knowledge creation, takes place when all four modes of knowledge creation are "organizationally" managed to form a continual cycle (Nonaka, 1994, p. 20). Over time, the individually created knowledge will through conversion between tacit and explicit knowledge expand to groups, organization and even to an inter-organizational level of knowledge. On the way, the knowledge creational process will go faster and produce more knowledge, illustrated by the growing radius of the spiral in Figure 3-2.

The previous part of this chapter described the nature of knowledge and how a company creates knowledge. The following describes knowledge management and the different ways of focusing on this in corporations.

3.4 Knowledge Management Strategy

Before discussing strategies for knowledge management, a definition of knowledge management should be in place, and I use the wildly used definition from Davenport & Prusak (1998) where they define it as *a method that simplifies the process of sharing, distributing, creating, capturing and understanding of a company's knowledge*.

Hansen, Nohria, & Tierney (1999) studies the kind of knowledge management strategies chosen by different companies, mostly consultancies. Based on their findings, they identify two different strategies:

- *Codification* is a strategy where knowledge is treated as an asset. Knowledge is codified into documents and stored in databases, and made easily available to the employees.
- *Personalization* is a strategy where knowledge is treated as being personal. The organization does not codify and store knowledge explicitly in databases, rather they identify the type of knowledge different employees possess and make this information about who knows what available to everyone. Hence, this strategy emphasizes the person-to-person knowledge transfer, while codification strategy promotes person-to-repository-to-person knowledge transfer.

In their article, Hansen, Nohria, & Tierney (1999) describe how different companies use one or, to some extent, both of these strategies. They conclude by suggesting a 80:20 ratio between the primary and secondary strategy. Both strategies should be used, but only one as the main, with approximately 80% focus. Their findings show that giving both strategies equal focus, would make none of the strategies work properly. Their empirical study includes McKinesey & Company who uses personalization strategy, while Ernst & Young is an example for codification strategy.

3.4.1 Schools of Knowledge Management

Earl (2001) suggests seven schools of knowledge management. These schools form a framework, which is useful to classify different knowledge management strategies and also to identify new ways of focusing on knowledge management. In contrast to the personalization and codification framework (Hansen, Nohria, & Tierney, 1999), this framework offers a higher level of granularity, and it also presents knowledge management as a broader concept including everything from knowledge databases to designing office space.

The purpose of presenting this framework of schools of knowledge management in this report is to show different approaches to knowledge management. Also, the empirical research literature on knowledge management in software engineering seem to fit into one or several of these knowledge management schools (Bjørnson & Dingsøyr, 2008). In the case study, different aspects of knowledge management are described, and although this framework is not actively used, it justifies the different focuses I choose in

the analysis of the case study. And because of not using the framework actively later, I will only give a very short description of the different schools.

There are three main schools, *technocratic, economic* and *behavioural*, in which there are more fine-grained categories as shown in Table 3-2. A short description of each school is given in the following.

Table 3-2: Schools of Knowledge Management. Partly extracted from (Earl, 2001).

Main school	School	Focus	"Philosophy"	Unit
Technocratic	Systems	Technology	Codification	Domain
	Cartographic	Maps	Connectivity	Enterprise
	Engineering	Processes	Capability	Activity
Economic	Commercial	Income	Commercialization	Know-how
Behavioural	Organizational	Networks	Collaboration	Communities
	Spatial	Space	Contactivity	Place
	Strategic	Mindset	Consciousness	Business

Systems school
This school focuses on using technology to promote and enable knowledge management, in similar manner as Hansen, Nohria, & Tierney's (1999) codification strategy. Knowledge databases are crucial when using this strategy and the company needs to validate the content of such systems, in addition to have incentives for providing knowledge assets to the knowledge base.

Cartographic school
In this school focus is on creating maps of organizational knowledge. The aim is to map who knows what, thus being similar to the personalization strategy described earlier. To succeed with such a strategy the organizational culture should promote people to share their knowledge and the company incentives to promote knowledge sharing between people.

Engineering school
This school focuses on the process where knowledge is needed and how to provide it when needed. Operating personnel and others should have access to former experience and expertise at the same time as getting fact and other information so they can make good decisions.

Commercial school
In this school focus is on treating knowledge itself as valuable, so here knowledge is copyrighted and patented. Companies using this strategy often

develop specialized teams who deal with making knowledge to intellectual property owned by the company.

Organizational school
This school focuses on using organizational structures and networks to share knowledge. This is where the concept communities-of-practice (thoroughly described in chapter 3.5) often comes in. The knowledge sharing is often personal, informal, and not a routine, and happens within communities (i.e. departments, teams, interest groups).

Spatial school
In this school the focus is on office organization and how to organize the office space to promote better knowledge sharing. Open-plan office, coffee bars, meeting places are examples of office designs made to help socializing, to have unanticipated meetings of people from different backgrounds so they can share knowledge.

Strategic school
This school focuses on using knowledge management as the core business strategy. Hence, this strategy can be seen as a strategy that can include a set of the other strategies. The important point in this strategy is that knowledge, or intellectual capital, is the main factor that keeps the company alive.

3.5 Communities-of-Practice

The concepts of tacit and explicit knowledge give rise to new ways of analysing and understanding knowledge sharing. Lave and Wenger (1991) first used the concept of *communities-of-practice*, and since then it has got its momentum especially in knowledge management studies (Walsham, 2001). Brown and Duguid (1998) define a community-of-practice as follows:

> *Through practice, a community-of-practice develops a shared understanding of what it does, of how to do it, and how it relates to other communities and their practices – in all, a "world view"* (p. 96).

In other words a community-of-practice is a group of people with a shared mental model of their surroundings. This definition implicitly states that a community-of-practice has a level of shared tacit knowledge that they may use in their daily work. Such a community-of-practice may for instance be a group of test engineers in a software company or a group of bakers in a bakery.

Walsham (2001) suggests that when dealing with knowledge sharing and developing information and communication technologies for knowledge sharing, we should recognise that knowledge is easily shared within a community-of-practice than across several communities, because of shared tacit knowledge. He also presents empirical support for his claim that the sharing of explicit knowledge through knowledge databases is not so effective in the sense that employees usually prefer sharing of knowledge through face-to-face communication. Face-to-face meetings, or at least communication where the participants know each other and know more of the context around their communication, give better learning and knowledge sharing due to better support for tacit knowledge.

Nonaka and Takeuchi (1998) present what they think is the main reason why Japanese companies are so successful compared to western companies. The Japanese view on organizational knowledge creation is very different from the western view in the sense that the Japanese recognise and value tacit knowledge. Nonaka and Takeuchi's claim is supported by Orr's (1990) ethnographical study of service technicians disobeying the management's order to use the corporate manual when repairing copy machines. The service technicians Orr studied belonged to a community-of-practice where they shared narratives about how they solved different reparation problems. They used informal arenas such as coffee breaks and lunch hours to tell their stories. Rather than following a static manual, which only gives a sequential list of actions to take for each error code, the narratives often explained the context of the problem so the reason for the problem was clearly understood by the technicians. The knowledge within the community-of-practice was always evolving with the new narratives and thus dynamic. Nonaka and Takeuchi's (1998) claim about western companies not recognising the tacit knowledge is surely visible in the service technicians' case where the management viewed the technicians' practice as not the correct corporate practice.

The presented articles about community-of-practice all describe the importance of viewing knowledge as both tacit and explicit, and to support the sharing of both of these. The community-of-practice is suggested as a fine-grained group where sharing of knowledge is easy due to similar tacit knowledge. Walsham (2001) remarks that Polanyi originally stated that tacit knowledge is different for all individuals because of their different life experience. The tacit knowledge is closely related to a person's experiences, so it is easy to grasp Polanyi's statement, but as Walsham concludes the tacit knowledge within a community-of-practice will naturally be better shared than tacit knowledge across different communities. The reason for this is intuitive: people in one community-of-practice will necessarily work more together and share more experiences than people across different communities.

4 Research Method

This chapter explains all aspects related to the choice of cases and the research method. It will give detailed information about the different data collection methods, the research design, and how the analysis was conducted.

4.1 Research Design

The choice between fixed or flexible research designs was easy for this study. Fixed design implies much pre-specification of the research questions and methods, while in flexible design *the detailed framework of the design emerges during the study* (Robson, 2002, p. 81). For my purpose it was of great importance that the research design can evolve during the study because this is an *exploratory* research where I do not know what the outcome may be or what parameters to study from the beginning. In other words, the study need to be flexible so it can adapt to the findings and the design be modified during research so I can pursue interesting findings. Also, if I had chosen a fixed design, all presumptions about possible knowledge managerial challenges will have served as basis for data collection, and in this way I could have been focusing on parameters not relevant for this case, and at the same time not touch into important knowledge managerial aspects within these specific cases.

Robson (2002) argues that among the three widely used research traditions within flexible design, *grounded theory, ethnography,* and *case study*, the latter is most suitable if the focus is to develop *an in-depth analysis of a single case or multiple cases* (p. 165). Ethnography is more suitable to describe a culture or a social group, while grounded theory, as the name states, is useful to develop theories grounded in the collected data. Case study reveals itself as the most suitable research strategy for this research because I need to do an in-depth analysis of three similar cases. Before going on describing this flexible designed research with case study as core approach for conducting qualitative research, there is a need to define the term *case study*:

> *Case study is a strategy for doing research, which involves an empirical investigation of a particular contemporary phenomenon*

> *within its real life context using multiple sources of evidence* (Yin, 1994).

As there is limited time and limited possibilities to access case study participants more than necessary, there has not been any pilot study, although such a pilot study would have helped in making my research questions, and initial knowledge about the research area, much better. To compensate, there has been arranged several meetings with my supervisors at the case organization so that I may get some case information. The initial data gathering focused on being *exploratory*, whereas the later part of the data collection phase focused on being *explanatory*. Hence, the newly acquired knowledge from the first cases was used to make the research focus more relevant and also try to get several sources to give information about the same issues so that the impact of bias could be reduced.

4.2 Choosing Cases

The cases that are used in this thesis where chosen by Mitos[5] (the case organization) and myself in dialogue, although the final decision of which cases to use was in the hand of Mitos. My requirements for the cases were:

- *Ongoing projects.* The project should be ongoing so I may interview people during their work, and have possibilities for observations.
- *At least teams in Norway and India.* The choice of these countries was because Norway is convenient with regards to travel and proximity, and India is probably the most important offshore work receiving country, as described in the introduction chapter. In addition, I know one of the Indian languages, and I am familiar with the culture, thus making me able to study the Indians both as an outsider, but also as one of them. Early in the negotiations, Mitos offered me a trip to one of their sites, and when considering India as an emerging and important market for IT, I found it very interesting to observe this first hand.
- *Accessibility to resources at both sites.* Obviously this requirement was crucial. Without access to resources, it would have been difficult to do the case study.
- *Development projects.* The cases should include development work, either as a new software development project, or as a maintenance project with much development work due to change requests.

[5] Mitos is a pseudonym for the case organization. Due to sensitive information, the real name is not revealed.

The final choice was a set of three related ongoing projects that are delivered to the same Norwegian customer. One of my Mitos supervisors works within one of these projects, so that seemed easiest when it comes to data collection in India because she has contacts within the Indian teams for these projects. The first two requirements were fully met; access to resources was very good in India, but in Norway it was not sufficient because of a hectic project period in Norway. All projects were maintenance projects, but with a great deal of development work due to bug fixing and change requests.

Limitation
It should be noted that when I have not chosen the cases entirely myself, there might be other unknown reasons for Mitos to suggest these cases. Although only assumptions, one obvious possibility may be that these cases are the most successful ones, so by giving me access to them, Mitos will be presented as a very capable company when it comes to offshoring. On the other hand, the set of projects offers a variety in the sense that it is three different teams, different technologies, different project size, different mixture of onsite and offshore resources, and the interaction model between customer and offshore is different among the projects. Hence, Mitos' suggestion of projects offers an academic advantage for discussing the implications of the differing factors. Also, I find the choice to be more dictated by the possibilities for accessing resources, rather than any political or strategic agendas, especially when considering that Mitos' real identity is never revealed in the report, there is nothing to gain for Mitos.

4.3 Data Collection Methods

Questionnaire, *direct observation*, studying *document* and *physical artefact,* and *interview* are suggested as suitable data collection methods for flexible designed research studies, with case study as research approach (Robson, 2002). This chapter describes all of these methods, while chapter 4.5 describes the whole research process and how these methods were used.

By combining several methods, such as interviews and documents, I get data in different ways, potentially being more complementary than only using one method. Especially when conducting an evaluation research, (Robson, 2002) argues that *there has been a tendency in small-scale studies to equate evaluations with the use of questionnaires (as the sole method) but evaluation is a complex field where the benefits of multiple methods are particularly clear* (p. 214). Although my research is not an evaluation research, some of my work can be said to evaluate Mitos' capability of conducting offshoring

and handle issues regarding knowledge management, thus making the above statement suitable for my research as well. I have used a mix of several of these methods, so that I can acquire information from different views.

The following of this subchapter will give a brief reasoning for why the different data collection methods mentioned above are useful. I have relied mostly on interviews for collecting data, so it is explained thoroughly, while the other methods are briefly explained.

Questionnaire

To be able to make a rather structured questionnaire I need substantial knowledge about the area of research and the cases so the questions in the questionnaire would be relevant. Although questionnaire is a suitable approach to gather information from a large set of people, due to my limited knowledge about the cases prior to meeting the informants, I needed a broader and flexible start on the data collection. After the data collection period I used a questionnaire-like approach when I sent emails to some of the interviewees, whom I had already interviewed, to get answers for new questions.

Direct observation

Observing people during their work, i.e. in a meeting where both onsite and offshore resources took part, would have given me much information about challenges they face when working over distances. This information could have been less biased because I observe their actions myself instead of them describing the actions with words. Direct observation was not possible due to time restrictions, and because it was not allowed for external persons to participate in such meetings without approval from management and the customer. Still, I was at this office for collecting data, and I was able to observe how they organize their offices, and I witnessed informal lunch-talks, and other similar settings. These observations are described in chapter 5.3.

Documents and physical artefacts

Documents and physical artefacts are other important ways of accessing information. Studying project documents like project plan, high-level design, minutes of meetings etc. prior to indulging in data collection with people from the cases, is a good way of getting the maximum output from the interaction with the people because then I would already have a brief understanding of their work and project, and I can focus on asking more in-depth questions. Unfortunately Mitos was not able to give me access to any case related documents prior to the interaction with the informants, so the advantage of

having some background information about the cases was not achieved. Nevertheless, I found having done a similar study last semester, and reading through publicly available information about Mitos' offshoring model and delivery centres very useful. Just to know the meaning of some often used abbreviations in the organization like NMO (Norway Mitos Office), IMO (India Mitos Office) and SME (Subject Matter Expert) was very useful when conversing with employees at Mitos.

Interview

My main data collection method was interview, so I will present this method thoroughly here. The information about what an interview is, how to design and conduct the interview, and tips on the circumstances around the interview, are all brought from chapter 9 in (Robson, 2002).

Interviews can have *open* and/or *closed* questions; the former requiring a type of longer and explaining answer while the latter has more short and clear answers. Examples of open questions can be "What do you think about the Norwegian organizational hierarchy compared to the Indian?" or "How did you like your holiday?". Examples of closed questions may be "How old are you?" or "What was your role in this project?". In making interviews, Robson (2002) argues that interviews mainly consisting of closed questions are in fact a questionnaire where the questions are asked and answered face-to-face, while what he calls an interview usually consist of mostly open questions. In this study, I have chosen to mainly use open questions because I do not have much initial knowledge about the cases, so creating closed questions is both difficult, and it can be foolish and misleading in the search of good findings. Some advantages with open questions are that they are flexible, allow deeper understanding, and they can find unexpected or unanticipated answers. The main disadvantages are that it may be difficult to control the answer so that it may be relevant, and the analysis phase will also be more difficult because of the vast amount of unstructured data (Robson, 2002).

There are mainly three ways of structuring an interview:

- *Fully structured interview*: The questions are predetermined and the wording is fixed. The order of the questions is also mainly fixed.
- *Semi-structured interview:* Many questions are predetermined, but both order and wording can change during the interview. The interviewer may also omit questions or add new ones if necessary.
- *Unstructured interview:* There are no predetermined questions, the interviewer has an area of interest he or she wants information about, and the talk between interviewer and interviewee is usually informal.

Because of the same reason as for not choosing closed questions, I did neither choose fully structured interviews. Unstructured interview may give a great overhead of information that is not interesting, and it may also be very time-consuming. The advantage of using semi-structured interviews is that I may have a set of questions to ask the interview subject, but at the same time I can acquire new information by just listening to the subject and ask new questions that seem interesting based on the subjects' answers. I have chosen to use semi-structured interviews with different degrees of structure depending on when the interview was conducted. In the first interviews the semi-structured interviews were very little structured, but later on, as my knowledge increased and previous findings indicated new interesting questions, the semi-structured interviews got more structured – though still not so structured that I would miss on new interesting knowledge. This way I achieve being more exploratory in my research in the initial few interviews, while I may look for more explanatory findings in the later ones.

The interviews may be conducted through telephone or face-to-face, and I have only used the latter. I am more comfortable with the interviewing process when I can see the person I talk with. Another reason for preferring face-to-face interview is the possibility to get more accurate information in the sense that I may use other senses than hearing, which for instance make it easy to know if the interviewee understands my question clearly or not by just studying his or her facial expression. I have only used telephone for informal clear-up questions, and not for conducting the interview itself.

Piloting interview is useful to improve my interviewer capability, because you can ask the interviewee to give his honest opinion on your interview (Robson, 2002). I did this in a way, but instead of asking the interviewee I asked my Mitos supervisor who participated as a support in my first interview. Having another person there did not make me feel more comfortable, however, it was useful to identify more useful follow-up questions.

All interviews were transcribed after the interview. The transcriptions were based on notes and memory for all the interviews conducted in India, while the one in Norway was based on voice recording. All interviewees got access to read through the transcripts for modifications, and the transcripts have been used only after their approval. The transcripts can be found in Appendix B, and whenever cited throughout this report it is done like (<Person>, <Appendix Nr>), i.e. (Ano5, Appendix B.4).

4.4 The Analysis Phase

Robson (2002) suggests using Miles and Huberman's framework for conceptualizing qualitative data analysis. I have mainly used the summarized version of this framework given in (Robson, 2002). Also, as Robson suggests, the framework is used selectively, choosing only the needed and suitable parts. In the following, I explain the parts from the framework I use and argue why they are suitable for my work.

The Miles and Huberman Approach

The analysis is viewed on as consisting of three concurrent activities: *data reduction*, *data display*, and *conclusion drawing and verification*. Miles and Huberman give guidelines for each of these activities. They also pinpoint the importance of indulging in these three activities during the data collection phase because it is important to be proactive – when data collection is ended the amount of data may be too great to deal with within a reasonable amount of time. By doing these three activities while collecting data, the researcher may be able to change the data to collect, and see new interesting patterns early and adapt the research to collect more data on these new findings.

Data reduction is important throughout the whole data collection period because collecting qualitative data can end up with a great pile of data that can be very painful to analyse. Miles and Huberman suggest that the researcher starts thinking on reducing data from the start of data collection. *Session summary sheet* and *document summary sheet* are two ways of reducing data by making summary of the session (e.g. an interview) or a document (e.g. a feedback report). The summary should be created right after the data collection of the session or the document. Another suggestion for reducing data is to *develop coding categories* so that the data can be structured or categorized during the data collection. In my work I started reducing data very early by not asking general questions about the project (i.e. how many resources are there in India and in Norway) to every person I interviewed. Also a short post-it note was attached all transcripts of the interviews, summarizing the findings I thought were useful at the time of transcribing.

Displaying data in different ways should be done during data collection so that patterns and interesting loose ends can be identified early. Examples of good ways of displaying the data are charts, network diagrams, matrixes and so forth. The process of creating diagrams or other ways of displaying during data collection enforces the researcher to summarize the findings and to see patterns, thus helping the researcher in the later process of concluding. During

the data collection work I found using matrixes for summarizing the main findings across different interviews very useful, both to see patterns regarding different roles and also to shortly summarize all the findings. The matrixes are presented in Appendix C.

Drawing conclusion and verifying that the findings are reasonable should be done throughout the data collection phase. This helps to identify possible conclusions early so the researcher may try to find more evidence to support it or try to find contradictions. If the researcher waits with trying to conclude to the end of the data collection period, the possibility to strengthen the conclusion is less because it may be less time to do more data collection. The use of matrix for displaying data also helped in drawing conclusions because it revealed that some issues were touched upon by several of the interviewees and also the process of creating the matrix forced me to look for concluding remarks.

It is easy to lock one's mind on findings from one interview and only ask about these findings in the next interview. This may hide away other possible information from the second interviewee. So, although I had some conclusive statements from one interview, which I followed up with the next interviewee, I chose to do that in the end of the following interviews so that I was able to get information that were not directed by my former findings.

4.5 The Research Process

The subchapters above presented research design, data collection methods and analysis approach as recommended by Robson (2002). I also presented briefly why and how I have used the different methods and approaches. In this chapter I will give a brief presentation of how this study was conducted so that all aspects of it are clearly explained. This is especially important for others who want to reuse my results or collected data to other research purpose, so that they know under which circumstance the data was collected.

I planned the order of activities so that I may get the most out of the limited time I had with the interviewees. I planned the progress for the data collection so that I may read the project documents early in the semester to get more knowledge about the projects and to focus on more in-depth questions when collecting data directly from the project members. Also I preferred conducting interviews in Norway prior to India, because I knew I will have very little time in India, which I wanted to use as effectively as possible, and by having done interviews before I would be better prepared.

The actual research process ended up being very different from the planned one, and it was mainly dictated by the possibility to access informants. Unfortunately, the order of activities was not productive and effective when it comes to acquire most useful information in a limited time. For instance, getting access to the project documents after the interviews was less useful than if I could have got them earlier from Mitos. Also the documents holding general information about the projects were very limited in the amount of information of relevance for this thesis.

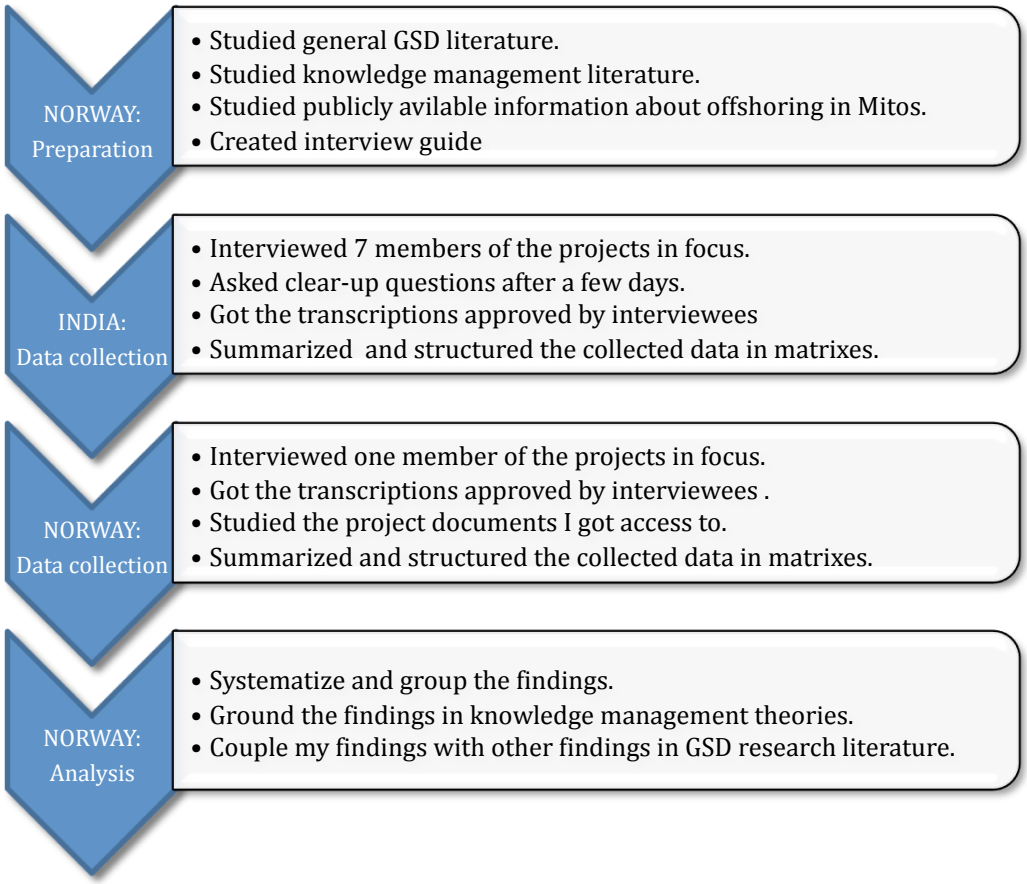

Figure 4-1: Research process.

Figure 4-1 shows the actual research process. The order of the blocks and the actions within each block in the figure are all ordered by time. The main difference compared to the planned research process is that I was not granted access to project documents before any of the interviews.

The preparation phase happened without any difficulties. My pre-study last semester was very helpful when finding relevant information. Because of the circumstances described in the preface, the work with the research questions I

use now was delayed several months, and therefore having read through much GSD and knowledge management literature last semester was even more vital. Mitos' website has much information about their offshoring practice and about their different delivery centres around the world. In addition I was granted access to a few internal documents about how Mitos handles offshoring to India. These documents were good for getting some context information and to prepare for data collection. The interview guide was made based on my knowledge after reading through the above-mentioned literature and documents. I also got feedback on the interview guide from my supervisors at Mitos and NTNU before it was used. The interview guide is presented in Appendix A**.**

The second block in Figure 4-1 describes the activities done in the data collection phase in India. Mitos facilitated a trip to India so that I could conduct seven interviews there. The time of my trip and one of my supervisors' trip to India coincided, and this was useful because she helped in finding the interviewees and arranging the interviews. Several unexpected circumstances caused much overhead time in India: difficulties getting visa to land in Bangalore, where the Mitos office I visited is located; an unexpected government holiday, which is specific for the state of Karnataka[6]. These circumstances made it possible to be at Mitos' Bangalore office for only two days for conducting interviews. My supervisor arranged the interviews by finding the people I could interview, thus it should be noted that the set of interviewees are not randomly picked, rather it was picked by one of Mitos' own employees. Mitos gave me access to interview those of their employees who where available at the time of my stay in Bangalore. My request for having a mix of roles in the set of interviewees was fully met so I have interviewed team leads, managers and developers, and more detailed information about them can be found in the case study presented in the next chapter.

Before each interview, I presented myself, and the purpose of my study; assured the interviewees about total anonymity on personal, project and organizational level; they also got assurances that I will not use any information from their interview unless they have approved the transcription of the interview. In cases where the interviews were taped they were assured that the tape would be permanently deleted after the thesis is written, and no one else than myself will be listening to those. All interviewees were given a sheet (Appendix A.3) with this information.

[6] Karnataka is the state where Bangalore is located.

Voice recording was strictly prohibited at the office in Bangalore, so notes and memory was used to transcribe all interviews. The interviewees got the transcription emailed so that they could comment any misunderstandings or misleading information. Mostly the transcription was approved with minor changes or no changes at all. All the approved transcripts can be found in Appendix B.

Nearly all of the interviewees got one or more emails from me after the interview asking additional clear-up questions or new questions, and the emails were mostly answered within a few days. The transcripts and the answers for the additional questions served as basis for creating a matrix summarizing the findings across interviewees, and another matrix summarizing the findings across projects. These matrixes can be viewed in Appendix C.

The third block in Figure 4-1 describes the activities done in the data collection phase in Norway. Only one interview was conducted in Norway because the projects had a patch release date coming up at the time, so I was not able to get access to more resources. After getting the transcript approved the data from this interview was plotted in the matrixes.

Now, I got access to several project related documents, but their relevance for my work varied. Due to confidentiality, these documents are not presented in the attachments, but the documents included:

- Quarterly feedback report from customer to Mitos Norway
- Quarterly feedback report from Mitos India to Mitos Norway
- Knowledge transfer plan for one of the projects I studied

The fourth block in Figure 4-1 describes the activities done in the analysis phase. Making matrix during data collection was useful for identifying the main challenges. I did the challenge identifying process in three steps. First, I wrote down the challenges I found on small cards, one challenge per card. Then I used the matrixes to identify those challenges I had forgotten, and also wrote these on cards. Last, I read through the transcripts in search of more challenges, and wrote those down on cards. By doing these three steps, I was sure of using my memory, earlier summarizing in matrixes and the raw data in the transcripts.

I used a form of affinity-diagram (or KJ-method after its inventor Kawakita Jiro) to aid the analysing process. Affinity diagram is often used in a group setting to classify a large amount of data into different categories. In my setting I spread all the cards on a table and tried grouping similar papers. After doing this for a while, I found a sensible grouping, and gave a heading to each

group. The resulting affinity diagram is presented in Appendix D. This classification scheme is used in the analysis in the next chapter.

4.6 Assessment of the Research Conduct

Doing a case study can be trivial and easy work if it is not done in a carefully considered manner with good planning, but then the quality of the work will be poor. If the research method is designed carefully, and good principles for conducting a case study is followed, the result will be of better quality and be a source of knowledge for others. Klein & Myers (1999) present a set of seven principles that should be followed when indulging in interpretive field research of a hermeneutic nature in information systems. For defining the interpretive field study in the field of IS, I look at this quotation:

> *IS research can be classified as interpretive if it is assumed that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools, and other artefacts. (...) it attempts to understand phenomena through the meanings that people assign to them* (Klein & Myers, 1999, p. 69).

My case study is interpretive in the sense that no hypothesis was used and it was exploratory. What I would find, if any, was unclear from the beginning, so the purpose was to observe and gather information related to knowledge management and communication, and try to interpret these and present them in a form, which may be beneficial for both researchers and practitioners. The social context, underlying assumptions and thoughts are all tried explained to make it possible for the audience to follow my interpretive process.

The term hermeneutic is important in this setting, because the principles apply most to interpretive field studies of hermeneutic nature (Klein & Myers, 1999). According to Oxford American Dictionaries the term hermeneutic is something *concerning the interpretation, esp. of the Bible or literary texts.* For the purpose of understanding the framework of Klein and Myers (1999) it is enough to understand the most fundamental principle of hermeneutics, which is the hermeneutic circle. Klein & Myers (1999) explain *the idea of the hermeneutic circle suggests that we come to udnerstand a complex whole from preconceptions about the meanings of its parts and their inderrelationships* (p. 71). An example is that to understand a sentence, one need to understand the words, and by understanding each word thorughly, the sentence is understood better. Thus, the terms *part* and *whole* are in focus, and the understanding of each of these improves the overall interpretation of each of them. Another example related to global software development is that understanding the

work process at each of the sites (the parts) makes it possible to understand the work process within the project (the whole), and then by understanding the whole, one would be better shaped to understand the parts. The understanding improves through the change of focus from whole to part, back to whole and so forth.

4.6.1 Principles for Interpretive Field Research

Now that these basic terms are discussed, let us study the proposed seven principles, which the authors suggest can be used in parts, but that all the principles are inter-related and that they should all be used together to *improve the plausibility and cogency of their (ed. researchers') accounts* (Klein & Myers, 1999, p. 79). Table 4-1 gives a short summary of the principles in the exact words of Klein & Meyers (1999, p. 72), while the rest of this subchapter is used to explain the principles thorughly and to assess how these principles are accounted for in my research.

The Fundamental Principle of the Hermeneutic Circle
The hermeneutic circles, in several iterations, implies that one should study parts and wholes, and how they affect each in turn. This principle is fundamental to the other six principles, and by accknowledging the other principles, one can account for this principle (Klein & Myers, 1999). In my case study, I have tried to study the different projects in the case study (the parts) to get an overview of the relationships among them (the whole). When considering the whole, new questions arised and new information revealed, and I then updated my interpretation of the individual projects.

The Principle of Contextualization
Giving relevant context information is needed to give possibilities to different interpretations, and to give reasoning for the interpretations. When not giving a social and historical context, the reader can not fully understand how the described phenomenon emerged and happened. From the field of anthropology, and etnographic field studies, the term *thick description* denotes much of the same, namely giving a through description of the environment and context of the happening g(Geertz, 1973). In my study, this is probably the principle that got most attention because of its importance to other principles such as *abstraction* and *suspicion*. First, a thorughly description of global software development, its drivers and challenges, and experience from other studies is given, so the reader can place my study in a research context. The historic evolvement of the projects in the study is given. Allthough focus was on studying present challenges within knowledge management, evolvement of these challenges is explained. Observations regarding the social

and educational factors in India, the lunch room talks, and IT infrastructure in India are all described to give the reader a picture of how it is to work with IT in India. Regarding Norway, I have tried discussing the Indian observations against the practices in Norway.

Table 4-1: Summary of Principles for Interpretive Field Research. Extracted (examples excluded) from (Klein & Myers, 1999, p. 72).

Summary of Principles for Interpretive Field Research
1. The Fundamental Principle of the Hermeneutic Circle This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles.
2. The Principle of Contextualization Requires critical reflection of the social and historical background of the reearch setting, so that the intended audience can see how the current situation under investigation emerged.
3. The Principle of Interaction Between the Researcher and the Subjects Requires critical reflection on how the research materials (or ”data”) were socially constructed through the interaction between the researchers and participants.
4. The Principle of Abstraction and Generalizaiton Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoritical, general concepts that describe the nature of human understanding and social action.
5. The Principle of Dialogical Reasoning Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings (”the story which the data tell”) with subsequent cycles of revision.
6. The Principle of Multiple Interpretations Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Smilar to multiple witness accounts even if all tell it as they saw it.
7. The Principle of Multiple Interpretations Requires sensitivity to possible ”biases” and systematic ”distortions” in the narratives collected from the participants.

The Principle of Interaction Between the Researcher and the Subjects

The social interaction between the researcher and the participants cause the participants to analyse and build their own interpretation of the researcher. Often only the opposite process is acknowledged, but in my case study participants' interpretation of me is described to some extent. Anticipations on my age, ethnical background and hierarchical position compared to the participants and other such factors are described to explain some of the

subjects' behaviours. By presenting such information, the reader may also build his or her own understanding of certain observations.

The Principle of Abstraction and Generalizaiton

Interpretive studies document unique happenings and describe their social and historical background, and take care for not arguing that human behaviour is controlled by natural laws that are culturally independent. Thus, generalizability and abstraction may seem difficult to achieve (Klein & Myers, 1999). In such studies, effort should be placed to contextualize the findings to abstract categories. *Unique instances can be related to ideas and concepts that apply to multiple situations* (Klein & Myers, 1999, p. 75). In this report, knowledge management theories and concepts (presented in chapter 2) are used heavily in the analysis of the findings to be able to abstract and generalize the findings. Although an occurence's social and historical setting makes it hard to reproduce or find in other places, I try presenting findings from other researchers with comparable occurences having comparable context, to try to generalize.

The Principle of Dialogical Reasoning

In interpretive research prejudgement and preconceptions are not regarded negatively, they are rather recognized as inevitable, and that they should be explained in the research material. My last semester pre-study, (Dharmadas, 2007), gave me much knowledge about different types of challenges in GSD. Throughout the data collection period, I tried to be open so that I acquire not anticipated knowledge, but sometimes, especially when the interviewee was reserved, the questions became verificational questions for my preconceptions. The reasoning behind my choice of knowledge management in GSD as the objectives for this report is accounted for in the introduction chapter.

The Principle of Multiple Interpretations

Multiple interpretations of the same phenomenon is of great importance to diminish the bias caused by one single individual's social and historical setting. In addition to the principle of contextualization, this principle has probably got most attention. Diversity of interpretation of the same issues is accheived by having a set of informants with a diversity of project roles, sexes, residence country and even different projects. This information is also clearly stated throughout the case study description and analysis. Peoples' interpretation of different happenings is tried explained by these factors. Triangulation of the findings were also tried to the extent possible.

The Principle of Suspicion

Several of the other principles encourage a critical approach dealing with the informants and the collected data. In addition to those, Klein & Myers (1999)

suggest *the researcher to "read" the social world behind the words of the actors, a social world that is characterized by power structures, vested interests, and limited resources to meet the goals of various actors who construct and enact this social world* (p. 78). In the analysis part of my case study description, the findings are tried explained with social factors such as power, personal gain and even sabotage. Some etnographic studies (Linstead, 1985; Orr, 1990) from the field of anthropology are used to increase my own knowledge of behaviour which is not easy to rationalize without being suspicious.

5 Case Study: Mitos – Project Desert

The case study has been facilitated by Mitos, a company delivering both technology and outsourcing services. Mitos, which is a pseudonym, wanted everything in this report to be anonymous due to business sensitive information. Therefore the general information about the company will be superficial and not detailed, or else it will be easy to recognize the identity of the company. The information about the company is brought from their web page, and not cited due to not revealing the company name, also this information is not vital for the thesis.

This chapter presents all aspects of the case study. The first subchapter presents the case organization, Mitos; the second subchapter presents the case and the three projects in this case study; chapter 5.3 presents some observations from my visit to IMO and India; chapter 5.4 presents the findings and gives a theoretic and empiric reasoning of these; chapter 5.5 discusses one of the main focuses of this thesis, namely GSD's impact on informal communication; the last chapter discusses validity and generalizability of my findings and discussion.

5.1 About Mitos

Mitos is a company with net revenue in the several billion-class, offices in tens of countries, and the total amount of employees exceeds several tens of thousands. They are a global actor in delivering technological solutions and outsourcing services to a wide range of customers worldwide. Mitos has their customer base in several major industry groups such as public services, communications, high tech, finance etc. Most of their large customers have been long-term clients, and this is also true for the customer in the case I have studied.

In relation to offshoring, Mitos has delivery centres all around the world, with India being the most important one with thousands of employees, though the company is neither Norwegian nor Indian. Mitos has been in India for over a

decade and has offices in several of the larger cities in India. The Norwegian department of Mitos (NMO – Norway Mitos Office) has in recent years started using IMO (India Mitos Office) as their offshoring partner. Though the entry of NMO into offshoring to India is relatively young, Mitos has developed standardized ways of handling communicational, organizational and infrastructural issues when dealing with globally distributed software development and maintenance. NMO takes advantage of using these standards, which are created through years of experience with offshoring and industry best practices. The informants at Mitos state that these standardized methods are useful and makes the offshoring go more smoothly than without them, but the interviews also revealed that there are issues caused by the different cultures. While the standardized methods may work (but not verified by myself) very well for Americans and other Europeans, there are some issues that arise which seems more specific to Norwegians, i.e. language barrier. Throughout the organization, English is used as the main business language, although when dealing with Norwegian customers, NMO often use Norwegian. This sometimes cause coordination and co-operation difficulties when IMO is involved.

My overall impression of the case study is that Mitos does many things in relation to offshoring in a proper manner. It seems like they have developed their capability of doing globally distributed software development over the years, and many of the typical beginner mistakes, such as not recognizing the impact of cultural distance, where not found. On the other hand some of the findings occur relatively infrequent in other case studies. For instance, I discovered that customer's reluctance to use English, because of being uncomfortable using other language than Norwegian, seemed a major challenge even though NMO was used as middleman in the communication between IMO and the Norwegian customer.

5.2 The Case: Desert

This chapter presents the different projects that served as case study. The main source of this information was my interviews, along with follow-up emails with employees at Mitos. Some data were also collected through direct observation, informal talks with Mitos' employees, and confidential documents I was granted access to.

Mitos has been delivering services within technology and outsourcing for a Norwegian telecommunication provider, NCom[7]. This customer relationship is over a decade long, and for the time being Mitos is the partner for over ten ongoing projects for this customer. Desert[8] is a project portfolio including several projects of varying sizes. I have used Desert as my case, focusing on three of the projects within Desert: ProjD, ProjO and ProjS[9]. I wanted to focus on only one of these projects, but due to lack of access to informants within a single project I had to choose several projects. Using these three projects was a compromise that was better than choosing only one project with poor possibility to collect data, or totally different projects which may introduce much overhead due to factors like different customers. The projects within Desert are similar in the sense that they have the same customer, and the systems in these projects interact with many of the same legacy systems at NCom.

Mitos' service to NCom in the different projects within Desert is mainly either AM (application maintenance) or AD (application development), or both. The different Desert systems interact with up to 40 legacy systems, which cause many of the systems to be fairly complex. Among the three systems in focus, both ProjD and ProjS were developed, delivered and deployed by NMO, and they have been in use at NCom for several years before IMO was involved in 2004. ProjO, on the other hand was in product testing phase when the Indian delivery centre was involved. IMO does mainly application maintenance work such as bug fixing in these three systems, but IMO also does some application development work when the customer has change requests or wants to add new functions.

Table 5-1 shows some of the high level properties of the three projects of focus: the type of system, if it is application maintenance or development, the amount of resources at NMO and at IMO, and the technologies used. It also shows the number of interviewees from each project, their role and if they are onsite or offshore resources. In addition I interviewed the overall Desert lead at IMO, but due to his overall belonging he is not mentioned in the table. It is easy to see that the number of interviewees is unevenly distributed among the three projects, and this is only because these were the resources I had access to for data collection. Due to this distribution of interviewees, I will also focus more on ProjO and ProjS than ProjD so the findings have at least some significance and not too biased by one person's view. ProjD will be assigned less importance in the analysis because of only having one informant.

[7] NCom is a pseudonym for the customer.
[8] Desert is a pseudonym for the project portfolio.
[9] ProjD, ProjO and ProjS are all pseudonyms for three different projects.

Table 5-1: Desert projects and some of their properties.

Text\Project	ProjD	ProjO	ProjS
Type of system	Rating and billing system	Order management application	Billing and purchase system
AD/AM	Mainly AM, but also AD	Mainly AM, but also AD	Mainly AM, but also AD
Resources in NMO	2	30-35	7-9
Resources in IMO	8	20	9
Technology	Cobol, DB2	J2EE	N/A
Amount and role of interviewees	IMO: 1 team lead NMO: 0	IMO: 1 senior developer, 1 team lead NMO: 1 offshoring responsible and AD team lead	IMO: 1 AM developer, 1 AD developer, 1 team lead NMO: 0

The eight interviewees' roles, project belonging, location, years in Mitos and Desert are all presented in Table 5-2. Although I repeat some of this data in the analysis in chapter 5.4, it is useful to study this table and look back on it when reading the analysis to get a better picture who the different interviewees are. Also, the transcripts in Appendix B give a much more detailed picture of these individuals. All eight interviewees are of Indian origin, and all but Ano8 resides in India and work at IMO. Ano8 has been living in Norway for several years and work at NMO.

Table 5-2: Interviewees and their characteristics

Interviewee	Site	Role	Project	Years in Mitos	Years in Desert
Ano1	IMO	Overall Desert lead in IMO	Whole Desert	3	9 months
Ano2	IMO	Team lead, Assisting overall Desert lead in IMO	ProjS	5	2,5
Ano3	IMO	Team lead	ProjD	1,5	1,5
Ano4	IMO	AM developer	ProjS	4	3
Ano5	IMO	AD developer	ProjS	2	2
Ano6	IMO	Team lead	ProjO	5	4
Ano7	IMO	Senior developer	ProjO	3	2,5
Ano8	NMO	Team lead for AD, offshoring contact	ProjO	4	3

In the rest of this subchapter I will present the three projects more thoroughly so the reader may get a grasp on what these systems are, how they are organized and a short view on how they have evolved over time. Last in this subchapter I discuss how these projects are organized, and what organizational model is used.

5.2.1 ProjD

ProjD is a rating and billing system for NCom's wire-line customers. It has a total of 10 resources, with eight offshore and only two onsite. The two resources at NMO are the project manager and one subject matter expert (SME), while IMO has technical resources with one of them being team lead. ProjD is considered as experimental in the NMO-IMO offshoring relationship because:

- The use of NMO as middleman in the customer-IMO communication is at a minimum so IMO handles this communication directly with the customer in most cases.
- The percentage of offshore resources compared to onsite is very high compared to other offshoring projects between NMO and IMO.
- IMO handles all phases of the software lifecycle from early requirements specification and analysis to testing.

Through informal emailing with a manager at Mitos Norway who works with offshoring, I got to know that there are two main reasons for these three special circumstances:

1. The client in ProjD was used to English because until 2001, the origins of ProjD lay with an American company and Mitos had extensively used their services till 2001.
2. ProjD is a relatively stable application compared to ProjO. The volume and frequency of changes are very high in ProjO and it requires constant client interaction.

Unfortunately I have only interviewed one representative for this project, the team lead in India. This may cause the data to be very biased, but also the overall Desert manager in India, and my supervisor at Mitos, have been giving their comments about ProjD, so the one-person bias is diminished, at least to some extent.

5.2.2 ProjO

ProjO is an order management application for NCom's wire-line customers. It has approximately 52-53 resources if you add the NMO and IMO staff. The total amount of people varies depending on the need, but generally it has been increasing, especially offshore. The distribution of resources between the two sites is around 30-35 at NMO and around 20 at IMO. It is mainly a maintenance project, but the change requests they implement may be of a size that is comparable to development projects. The project is organized with two teams, one for application development (AD) and one for application maintenance (AM). AD teams are the largest, both in NMO and IMO.

There are both technical and managerial resources at both sites, but NMO does more managerial work, and more of high-level design, requirements specification, functional design and acceptance test. IMO on the other hand does more coding, detailed design and unit testing. All new code and modification in existing code are gathered to patches that are released and deployed quarterly.

5.2.3 ProjS

ProjS is a billing and purchase system for NCom. It is a total of 16-18 resources in ProjS, where 7 - 9 are onsite staff and 9 are offshore resources. The teams at both IMO and NMO are divided into one AD team and one AM team. The communication between customer and IMO goes mainly through NMO as middleman, so there are very few circumstances where customer and IMO team members interacts.

IMO handles mostly coding and unit testing, and the project itself is mainly a maintenance project, but change requests or request for functional additions from the customer causes writing new code.

5.2.4 Organization of Desert Projects

Research literature often deals with intra-organizational, inter-organizational, or outsourcing GSD-arrangements, as described in chapter 2.2. The organization of Desert does not fully fit into any of these three organizational models, and it is rather a combination of two of these arrangements, namely intra-organizational and outsourcing. It is an intra-organizational arrangement because it has intra-organizational teams located in different physical sites

(NMO and IMO); it is an outsourcing arrangement because there is one organization outsourcing the development work (NCom), and one supplier who do the outsourced work (Mitos). While research literature often considers one of the organizational models, this thesis discusses a model that combines two of the models, and therefore enhances the dimension of complexity even further due to dealing with three parts, rather than two.

All three projects within Desert have this three-part relationship, but as described, in ProjD NMO is less visible in the communication, while ProjO and ProjS use the three parts heavily. Hence, ProjD's model is more like a pure outsourcing rather than the combination model in ProjO and ProjS. As the analysis in chapter 5.4 will show, the combination model introduces more communication difficulties, but on the other hand, the positive effect of NMO's role of masking the socio-cultural and physical distance will also be described.

Now, let us study some of my observations from India and the office there.

5.3 Observations From Visit to IMO

The heading can make the reader think that this subchapter does not belong to a master thesis written in the field of information systems, but as several anthropological studies (Jordan, 2003; Orr, 1990; Linstead, 1985) show, there is a great importance to see the value of other aspects than only the technical one, when studying technology companies. Klein & Myers' (1999) principle of contextualization, as presented in chapter 4.6.1, requires a *thick description* (Geertz, 1973) of the case study. This subchapter tries to give a brief description of my observations regarding the diversity of people and language, the hierarchical and stratified society etc. Hence, answering the requests from the contextualization principle and to some extent giving a deeper description of the observations as in anthropological works.

The trip to India was useful for observing the Indian culture and way of being first hand. Although confidentiality and security reasons caused that I was not granted access to observe Mitos' Indian resources at their daily work, I have been two days at their office, eaten lunch with them and walked around in their corridors, giving me an impression of their way of working. These impressions and observations are described in this subchapter.

I am of Srilankan[10] origin, giving me the possibility to understand Indian culture faster than native westerners, but at the same time I have lived in Norway for almost two decades, giving me the possibility to look at the Indian way of being with new, fresh eyes. Such cross-cultural experience was useful during this case study because of easier interpretation of socio-culturally dependent behaviour.

My first meeting with the Indian bureaucracy happened already before arriving in the country. The Indian Embassy in Norway easily approved the visa application, but I was not granted allowance to land in Bangalore, which is where Mitos' office is located. Rather, I had to land in Chennai, in the neighbouring state of Tamil Nadu, because of my Srilankan origin. According to the Indian authorities those of Srilankan origin have to land in Chennai regardless of their final destination in India, so I had to do the same. This was both unexpected and introduced more overhead time travelling. This was not a major issue, but an example of how totally unexpected circumstances can affect a software development project if it had included any Srilankans in the NMO who had to travel to India for one or another business reason. Similar cases occur often in the visits in the opposite direction, from India to Norway, because of the Norwegian Directorate of Immigration's (UDI) slow treatment of entry visa applications (Teknisk Ukeblad, 2007).

Similarly, another experience from my stay in India is worth mentioning. As many other developing countries, India has its share of difficulties and conflicts due to scarce resources (ACM Job Migration Task Force, 2006). The neighbouring states Karnataka and Tamil Nadu were in conflict due to water resource utilization of a river running through both states[11]. This is actually a conflict that has been on and off for several years, and at the time of my visit it was at its height with Tamil cinema actors fasting in Tamil Nadu, Tamil movies banned in Karnataka, demonstrations, and difficulties to travel between these two states. Although I did not encounter any problems travelling from Chennai (in Tamil Nadu) to Bangalore (in Karnataka), I saw road blockades and was warned by taxi drivers about problems that may occur on the trip between these two cities. This is another example of sudden problems that may occur when doing business in India. For instance some IT workers in Bangalore are from Tamil Nadu and travel home on some weekends, and in such circumstances, they may face difficulties travelling by bus or car.

[10] Sri Lanka is one of India's neighbouring countries, with similar culture and religion. I also speak Tamil, the language spoken in southern India and in northern Sri Lanka. My skin colour and facial contour also makes me blend in at the Indian office.

[11] Source: http://news.bbc.co.uk/2/hi/south_asia/7329959.stm, retrieved May 15, 2008

5.3.1 Infrastructure

As reported by ACM Job Migration Task Force (2006) India's infrastructure is substandard. This goes for both the traffic situation in rush hours, which is an experience in itself, and Internet speed. At Mitos' office the Internet bandwidth was sufficient for my purposes such as accessing my email server in Norway, check Norwegian newspapers and send documents. The apartment I stayed in, used by some Mitos employees living outside their home city, had slower and sometimes unstable Internet connection. Also, the Internet usage among the population is very low, being 3,7%[12], while the same number is 88%[13] for Norway, both measured in 2007. The broadband penetration in India was as low as 0,2%[12] in 2007. Such numbers has implications in the sense that the access to Internet is more or less lacking when not at work or at school for IT-workers and IT-students.

During my stay with an Indian family in Chennai I had several interesting discussions with two (one second year, and one final year) BSc students in computer science. Although their grades from their university were above average, they had never heard about the term *agile methodologies*, nor did they, or their friends among their classmates, use Internet search engines to access tutorials to learn programming languages or to find solutions for coding issues. Compared to my studies in Norway, where we learned about agile methodologies as early as in the second year, this was surprising for me. Also, *googling* for example-code snippets, error stack trace, and the use of tutorials for learning to code common functions, are indispensable when we do coding assignments at NTNU. These students, on the other hand, told me that they relied heavily on books for learning new programming languages. The reader should note that the quality of education varies significantly in India, and these observations may give an incomplete picture. Thus, the validity of these observations is questionable, however the observations at least pinpoint that differences exist across these two countries, and that they may cause issues.

The two students, going to two different engineering colleges, told me that they had access to computers at their college only when they had computer lab courses or assignments requiring coding. Else, they had no access to use computers on campus. Although both of them come from the Indian middle class, they had no Internet connection at home, similar to most of their classmates. They have their own laptops at home, but for using Internet for

[12] Source: http://www.internetworldstats.com/top20.htm, retrieved May 15, 2008
[13] Source: http://www.internetworldstats.com/stats4.htm#europe, retrieved May 15, 2008

surfing, chatting, emailing to friends etc. they have to go to Internet cafés. These conversations with these two students revealed for me that their use of Internet technology and computers are very different from what Norwegian computer science students are used to. The limited exposure to state-of-the-art technology news and trends through the Internet can cause lack of the overall picture of the technological interplay. Because they are not using search engines and the web to search for solutions for errors in the way Norwegians do, they have to develop other ways of solving problems when coding. I did not talk to them about their problem solving process, but I will guess that they use books and trial and failure, which from my experience often give a more in-depth knowledge about the solution than only finding a solution on the Internet, but on the other hand, it can be more time-consuming.

The purpose of describing these differences in the way of working with coding assignments and the access to Internet is to pinpoint the differences across Norwegian and Indian students (and new joiners). Such differences should be openly discussed and addressed when people from two very different societies, such as the Norwegian and the Indian, go together and develop or maintain software together. With these examples in mind, it is easy to understand that what a Norwegian developer may think is easy, or common sense among developers, may not be that at all for an Indian developer, and vice versa.

Another unexpected finding was that the computer science classes in India had almost 50% female students, according to the two students I talked with, whom also were women. When they were informed that in my class in Norway there are approximately 10% female students, they were stunned. As mentioned earlier, NASSCOM Foundation (2008) reports that the female-male ratio in Indian IT industry is 30:70 in 2007, but they predict it will be 45:55 in 2010, correlating with the statement of the two students.

5.3.2 Daily Life at IMO

Being at IMO for two days and sharing office with Mitos' resources at IMO, gave me an impression on how it is to work there. Having visited Mitos' Norwegian office several times it was obvious for me to look for similarities and differences across these two offices for the same company, but situated half a world apart.

Mitos' office in Bangalore looked like any western office for a large company both inside and from outside. I was not granted access to the developers' work area, only to their meeting rooms, their canteen and coffee table areas. Later, I

was told that IMO resources have fixed workspace with secured bays for different projects. NCom projects have a secured bay where others were not allowed. In Norway, on the other hand, the office space is more open where people choose different work places each day. Earl's (2001) spatial school of knowledge management describes office space organization as a strategy for promoting knowledge sharing. In this case it seems like Mitos has used different spatial strategies at the different locations, where in Norway more effort is laid on promoting informal communication due to incidentally meeting people. Though coffee table areas exist at both sites, it is more integrated and given a more central location in Norway. Because of lack of own observation and no clear understanding of the office space in India, I will not pursue this discussion.

One very visible difference compared to NMO is that there are a lot of security personnel at IMO. There was at least one watchman on each floor, at the reception and at the entrance to the canteen. At NMO I have never seen any security personnel at all. All visitors had to show ID in the reception, and if you brought a laptop it was to be registered with serial number, and the laptop bag was marked showing it had a "visitor laptop". In my case, I had to be accompanied by one of the Mitos employees wherever I wanted to go. Similar to in Norway, I had no access to open any of the code-locked doors, so my contact person at IMO had to open the doors for me. The restrictions on my freedom of movement caused some awkward moments such as not being allowed to go back to my office after visiting the rest room, and another time after being at lunch. I had to call for my IMO contact person who had to accompany me back to my office.

Several of the interviewees also told that they only had access to common areas and their project specific areas. Different projects had different work locations within the same building, and they had no access to areas belonging to other projects. This strict environment can be explained by several reasons, but these are only assumptions. By limiting one's access to information to only be specific to their project, there is less risk of a high degree of information leakage when one employee change employer. The employee turnover is high in India, as mentioned earlier, though according to a manager at Mitos Norway, IMO is below the average in India (exact number is confidential). Other reasons may be that the western customer may require such strict environment because they are not familiar with Indians, thus taking more precautions than maybe necessary. Other researchers have also identified such trust issues (Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006). Note that these explanations are possible explanations, but mainly assumptions by the author.

The office I was granted was a meeting room, looking very similar to those in Norway, where I was able to work on my thesis in private. My supervisor arranged for interviews, and the interviewees attended one after another for interview with me in the meeting room. My supervisor also attended the first interview, so we were three people. She aided with some good questions when I was finished with my interview, and though not being alone with the interviewee was more stressful, it was useful so I could get feedback from my supervisor about my interview.

The canteen was organized as a food court[14], where the different food stalls served different types of food such as vegetarian, North-Indian, South-Indian, western etc., in a way demonstrating the diversity of India. Usually the employees ate breakfast and lunch at the canteen, and sometimes also their dinner. I joined my supervisor and 4-6 other IMO resources for my meals. I was in a way surprised by not being asked many questions about what I was writing for my thesis. Although my supervisor introduced me, told I was a student from Norway writing about offshoring, very few of these other resources asked questions of any kind. Similar situations in Norway have always ended up with me telling much about my thesis because of a lot of questions. I was younger than almost all the other people and lowest in the usual Indian business hierarchy because I was still a student, and not even a junior developer. In such circumstances, it is them who often make the first talk, but in my case, I had to start most of the conversations. The reason for them to not start conversing may have been shyness, no interest in my work, having my supervisor around (who is a superior to the others around the table) or any other reasons, but the majority of the interviewees were very open and asked me questions about Norway and my thesis before or after the interview (which only included the interviewee and myself). Also I noted that the Indian employees were like the Norwegians when it comes to talking informal talks around the dining table, but around my table it was more silence. It is important to not interpret these observations to find facts or truths about Indians, but some assumptions can be made. The dining table situation may for instance show some signs of Indians being much more open and communicative in one-to-one talks than a group discussion with people (actually one NMO manager advised me to conduct one-to-one and not group interviews in India) they have not met before, or they may be very reluctant to converse openly around their superiors.

[14] Food court: A shared dining area surrounded by multiple food vendors. A common sight in Asia.

5.4 Analysis of Challenges and Solutions

The data foundation for the analysis is too sparse if I am to consider each of the three projects one at the time. Also, they have many similarities as being in the same project portfolio, having the same portfolio lead, delivered to the same customer and the systems interact with the very same legacy systems. Thus, the systems can also be viewed on as one whole system with different subsystems. For these reasons I collect the findings from the three systems and merge them in the analysis in this subchapter.

There are many ways of organizing the findings. Herbsleb & Moitra's (2001) suggestion for organizing the issues faced in GSD is explained in chapter 2.3, and the groups are:

- Strategic issues
- Cultural Issues
- Inadequate communication
- Knowledge management
- Project and Process management issues
- Technical issues

This grouping seems sensible, and I have used this grouping scheme on my analysis of the challenges faced by Siemens in their GSD projects in (Dharmadas, 2007). Other case studies on challenges and solutions in GSD group the findings based on the natural grouping of the findings (Mullick, et al., 2006; Battin, Crocker, Kreidler, & Subramanian, 2001), and in this case study I will be using the same strategy. When analysing the collected data, the different challenges seemed to group themselves within a few general groups, so I have chosen to use these groupings because they seem more natural than using any fixed grouping that may not suit my findings.

The knowledge management (KM) challenges met in the three Desert projects are grouped into six categories as presented in Table 5-3. The reader may not agree that all these challenges relate to knowledge management, but I have chosen a very broad view on knowledge, and throughout the discussion their link to knowledge management will become clear. Earl's (2001) knowledge management schools, described in chapter 3.4.1, support this broad view on knowledge management. The categories in Table 5-3 will be the basis for the analysis, and they will be dealt with in the following subchapters. However, the main challenge in focus in this thesis is informal communication, hence, most effort is laid on the analysis of this type of communication, presented in chapter 5.5. Also, not all challenges are easily explainable with knowledge management theories (psychology and sociology may have theories suitable

for explaining concepts like shyness, reserved personality etc.), and in such cases I have been more descriptive than analytic. Within each of the subchapters the discussion will have three main areas of focus:

- Description of the challenges and theoretic reasoning of these with foundation in the knowledge management theories in chapter 3.
- Short description of the implemented solutions and theoretic reasoning of these with foundation in the knowledge management theories in chapter 3.
- Relating these findings to other scientific work done by other researchers, mainly within GSD, as presented in chapter 2.

Table 5-3: Grouping of knowledge management challenges in Desert.

Issues	Explanation
Communication model	Issues caused by the chosen way of communicating with NMO as middleman.
Personal and cultural factors	Issues caused by human and cultural factors such as reserved personality, and lack of cultural knowledge.
Language diversity	Issues caused by the diversity in languages used by the stakeholders.
Trust and confidence	Issues caused by lack of, or low level of trust and confidence on each other.
Knowledge distribution	Issues caused by the unevenly distributed knowledge level across different sites.
Strategic issues	Issues caused by management's strategic choices, or lack of focus from management.

In addition to these issues, which will be discussed later, I also observed the difficulties using emails rather than direct face-to-face, telephone or other synchronous communication. Throughout the project I have been sending over hundred emails to different employees at Mitos, both IMO and NMO resources, and missing out on answering thoroughly seemed to be a common problem when using emails for asking for answers to a set of questions. I have been sending emails with a set of questions ranging from 2 to 10 questions, and often at least one of the questions were missed in the answer. To cope with this I tried deliberately writing the questions in a way that required only a short answer, in addition to numbering them. These actions helped improving the quality of answers. I also noted that developers were better at answering all the questions than people higher up in the hierarchy. I can only anticipate the reasons for this to be that managers are often busy with a lot of different work assignments, and that they are used to answer emails in a hurry. Other explanations may be that developers may have a feeling that the management may have initiated my research work, causing them to not want to be seen as uncooperative. I also experienced that emailing in a foreign language

(English) is hard when trying to express myself exactly the way I wanted to be interpreted. This often caused misunderstandings that I became aware of later on. When I express myself in Norwegian, I am more capable of writing nuanced so that I have a better picture of the receiver's possible interpretations.

This experience with the emailing communication may not be representative to the email-communication between the stakeholders in the Desert projects. Unfortunately, studying the email-communication within the Desert projects was not possible. But I asked three of the interviewees per email about how they feel about emailing, and if all their questions usually get answered. The answer was that all of them were content with the quality of the answers. They also told they preferred emails because then the answer is documented. If the questions were asked through telephone, they may forget the answers, they told.

If my experience is representative, the email communication can be frustrating, but it seems like the employees are satisfied with the quality of the answers. A noteworthy detail is that all three interviewees responded to all my questions, but in some of the answers it seemed like they did not interpret the question the way it was intended by me. This may be due to my disabilities to write the question clearly, or my assumptions about their tacit knowledge, which is crucial in the process of interpreting, may have been totally wrong.

Now, let us discuss the six categories of knowledge management challenges in detail.

5.4.1 Communication model

The challenges in this category is caused by the communication model used in ProjO and ProjS, which requires use of NMO as middleman in the communication between customer and IMO. The customer and IMO have direct contact in ProjD, so these challenges are not met in ProjD. Three different issues are identified as challenges due to the three-node communicational model:

- Using NMO as middleman is a delaying factor in the communication between IMO and customer.
- Using NMO as middleman cause mismatch in the original message from customer and the information received by IMO.
- Using NMO as middleman makes it difficult to hold track on volatile requirements.

These three points are so tightly coupled that I discuss them together in the following, rather than splitting them up. Also, the reader should remember the temporal distance between Norway and India while reading. The time difference is 3,5 hours in the Norwegian summer time, while it is 4,5 hours when it is winter in Norway.

An example of the communication process within ProjO was explained by the Indian team lead who is also a developer (Ano6, Appendix B.5): If there are any defects, the customer reports it in Norwegian by logging it into a system, called ITG, which holds all the reported defects. NMO checks ITG and contacts the customer if they do not understand the explanation of the defect. After some communication back and forth between onsite team and customer, NMO gets a good view of the problem, they find a solution to the problem, and asks IMO to implement and test the solution.

Now the responsibility is handed over to IMO, who are supposed to write the code and test the solution. The IMO team writes a report in ITG after they have implemented the solution. This way the error and solution for the error is documented at one place. According to this interviewee one of the main challenges with this communication model is that the information IMO gets of the defect is a short version where NMO explain the problem as they have understood it after some email correspondence with the customer, or else they would translate one of the last emails from customer where they feel the defect is explained thoroughly. While NMO sends several emails and clear-up questions for getting to know the problem in depth, IMO only gets one of the last emails or a short defect description by NMO. The interviewee feels that IMO does not get as good view of the defect as they would have got if they were able to read through the full mail correspondence.

In ProjD the situation is strictly the other way around where the Indian team interacts directly with the customer in Norway. The communication is mainly written, and orally only occasionally because the customer does not feel comfortable using English orally. Similarly, many IMO resources in ProjD prefer written communication because of a reserved personality (Ano3, Appendix B.3), also in the Siemens Global Studio Project (GSP) the Indian team preferred written media above those requiring oral interaction (Dharmadas, 2007). The IMO team lead in ProjD explains that it is three main benefits when the communication is organized so customer and IMO team can interact directly (Ano3, Appendix B.3):

1. Easy to get a clear expectation of what the customer needs.
2. Few misunderstandings because IMO may ask clear-up questions right away.
3. No delay, because there is no middleman (NMO).

In ProjS, requirements analysis is often done by NMO alone, without including IMO, so IMO will only receive the requirements after NMO has identified those with the customer. When the requirements are received by IMO, they sometimes experience mismatch in the received requirements and what the customer originally defined. *Requirements does not reach to IMO properly*, Ano4, a maintenance engineer in ProjS at IMO, states clearly (Appendix B.4).

An application development (AD) resource working in ProjS at IMO said:

> *We won't be able to solve the problem even though we can because we don't understand some of the new requirements or problems due to inefficient communication* (Ano5, Appendix B.4).

This quote also illustrates the difficulties getting correct detailed understanding of requirements or errors because of using NMO as middleman. Still, the same informant says that when dealing with managerial issues the communication is good even if onsite resources are middlemen. The challenge is when there are technical or functional issues, or other issues regarding requirements, that need to be discussed.

There may be several reasons for the mismatch that occurs when information goes through a middleman instead of going directly from sender and receiver. Sabotage is not unusual in business, where different actors within an organization may use sabotage to protect their own interests, or even use sabotage regardless of immediate problems, as long as it gives benefits in the long term (Linstead, 1985). By not writing the requirements in detail and correct, NMO resources can sabotage IMO's work, giving the Indian team difficulties delivering a product the customer will be satisfied with. This may give the NMO resources more work and long days to help fix IMO's mistakes, but in the long term they may be beneficial in the sense that they will be regarded superior to IMO. There are also examples from GSD-projects were one site was reluctant to share information due to fear of loosing job (Herbsleb & Grinter, 1999b). Though sabotage is a possible explanation, several other findings go against such a deduction. First, none of the IMO resources believe that NMO resources hide or sabotage information deliberately. Second, IMO only deliver what is stated in the requirements specification, which was handed to them by NMO. Hence, if any requirements are not clearly described, it is a shortage in the work of the requirements gatherers at NMO, thus making them accountable for the problems. Third, challenge of mapping the user's needs and wishes into the requirements specification has been everlasting, also in co-located projects (Ågerfalk & Fitzgerald, 2006).

A more rational, but not that obvious, reason can be found if we look into the knowledge management theories that state the importance of tacit knowledge when interpreting information. Nearness to customer, and knowledge about the domain, developed over time ends up being a great source of tacit knowledge for NMO resources, a tacit knowledge that does not exist in the same amount at IMO. When NMO writes the requirements specification there is no need to specify every detail clearly, because some of the information is taken for granted by NMO, but may be crucial for IMO to get the correct understanding.

As stated above, NMO will necessarily have a higher degree of tacit knowledge related to the customer; and as stated by Nonaka and Takeuchi (1998) *without some form of shared experience it is extremely difficult for one person to project himself into another individual's thinking process* (p. 220). Hence, sharing of tacit knowledge through tacit to tacit transfer, socialization, between Mitos and customer, is easier for NMO than for IMO. The same fact causes internalization process to be easier for NMO. Tacit knowledge is hard to express explicitly, and therefore metaphors and analogies are often used to aid the externalization process. When the customer need to externalize their knowledge, they may use analogies, but such analogies are not worldwide interpretable, i.e. they are not sensible to everyone because of their different cultural background (Geertz, 1973). Also, the requirements received from customer are often only a few lines, thus there is a great need for Mitos to have close interaction with the customer for trying to get a good interpretation of the customer's needs. These arguments point out that it would be easier for NMO than IMO to gather the system requirements through interaction with the customer, and in addition to customers' comfort level and economic aspects, these reasons may be why Mitos chose to use NMO as middleman in ProjO and ProjS.

Still, when IMO is an important brick in the process of developing the functions required, the knowledge has to be transferred further from NMO to IMO. The hermeneutic circle denotes that human being's interpretive process happens in several repeated iterations of understanding the parts and the whole. NMO's repeatedly interaction with NCom to understand the error can be viewed on as an interpretive process of the type of a hermeneutic circle. By not giving IMO the possibility to take part in multiple iterations of the hermeneutic circle, but only the last one, their interpretive process of the problem will be lacking the first building blocks of knowledge. IMO has to internalize the information - fully understand the requirements, or else the implementation will not reflect the needs of the customer. However, without much shared tacit knowledge, as in communities-of-practice, such knowledge transfer is not easy.

It is interesting to see that the problems ProjO and ProjS report on the use of NMO as middleman is exactly what ProjD finds not present in their project. Delay and misunderstandings are two of the issues faced by ProjO and ProjS because of using NMO as middleman, while the ProjD informant indentifies no delay and fewer misunderstandings as the positive aspects of dealing directly with the customer from IMO. One may think Mitos has found their solution for the problems occurring due to the use of middleman, namely just remove the use of middleman, but such a dogmatic conclusion can not be made because ProjD requires much less customer interaction and is less complex than ProjO. In fact, as mentioned in the description of ProjD, these are two of the reasons why Mitos chose to have direct communication between IMO and customer in ProjD.

Another interesting point is that in ProjS the use of NMO as middleman is considered a problem only when dealing with technical issues, not when it is managerial issues. The technical staff always uses their team lead or offshore lead as a point of contact when dealing with issues regarding management of the project, but when it is any technical questions the developers make direct contact with NMO. It seems like using NMO as middleman is not a problem when dealing with managerial issues, but only when it is technical issues. The fact that it was a developer who reported this to me is crucial because she may not know what kind of problems her team lead experiences when dealing with NMO. If her team lead does a good job dealing with the issue, the developers are shielded to these issues. Another explanation may be that the team leads in IMO are more used to interact with NMO, thus making it easier to deal with issues requiring such cross-country communication.

The reader should note that the use of middleman shrinks the socio-cultural distance, thus aiding interpretation due to more shared mental model. If IMO had to deal with the customer directly, it will be cultural distance in two dimensions, one organizational and one national, as in pure offshore outsourcing arrangements. Thus, the shared tacit knowledge will be low, while using NMO as middleman, NMO has only one dimension of cultural distance to each of the other stakeholders – national distance to IMO, and organizational distance to IMO. Therefore, NMO is a suitable bridge to diminish the socio-cultural distance between IMO and customer. Therefore my argument, supported by the empirical findings, is that a certain level of middleman use is necessary in nontrivial projects that require much customer interaction. But efforts should be in place to include IMO more in the customer interaction, *together* with NMO, to help build a shared mental model, a shared tacit base, for aiding future interpretation process for the Indian resources.

One of Mitos' solutions for cope with difficulties with the three node communication is the use of minutes of meetings, or summary emails, where IMO resources write down a short description of what was agreed on in the meeting or phone call. At Siemens, similar practice with writing minutes of meeting is reported, but here they have brought this practice even further (Dharmadas, 2007; Sangwan, Bass, Mullick, Paulish, & Kazmeier, 2007). In the Siemens study, they used a similar approach where they had a structured way of passing on knowledge to new project members (similar to Mitos' New Joiners Kit presented in chapter 5.4.5), which also included doing assignments. The assignments forced the new joiners to get a good understanding, which requires internalization. To verify the new joiners' internalized knowledge, they had to give a report on what they had learned, thus the new joiners had to externalize their knowledge again.

5.4.2 Personal and Cultural Factors

In this report, I have chosen to group some person specific behaviour and cultural (i.e. national culture) together. The reason for this is that rather than cultural differences, some of the findings are more person-specific. For instance, shyness is a characteristic common to many Indians according to many of the interviewees, but at the same time Norwegian employees are also said to be shy in some interviews. On the other hand, some issues are enhanced when there are different national cultures.

Two different issues regarding personal characteristics, and one caused by cultural diversity were identified:

- Shyness among some individuals causes less communication.
- Some developers who do not fully understand the importance of reporting status cause misunderstandings.
- Uncertainty due to differences in national culture.

Shyness

Shyness, or reserved personality, is a personal characteristic that can cause communicational issues because it often hinders open communication. My findings also indicate that shyness is more related to personality rather than culture. The offshoring lead for ProjO at NMO describes the shyness issue at her office space in Norway as:

> *When it comes to shyness... I have lot of resources here (ed. at NMO) who come and talk to me (...) after every 10 minutes, and I have some few resources who do not even talk, but only send emails, even though they are sitting next to you* (Ano8, Appendix B.7).

Four of the interviewees in India were asked the question *Think of myself as an NMO SME that you have never met or talked to. How would you feel about contacting me for questions?* The answer from three of these four was that they would strongly prefer email for the first contacts. The last person told that she prefers email first, though she would not hesitate using the telephone either. Two of the interviewees said that they would not have wanted to make a telephone call at all because they feel uncomfortable with talking to the Norwegian SME without having met him or her personally, or seen the person concerned on a videoconference in advance. They feel that after personal meeting or after a videoconference, they will not hesitate that much to pick up the phone and call the SME.

Status reporting among developers

According to Ano8 (Appendix B.7), the ProjO offshoring lead at NMO, the physical distance has impact on the information flow, which is confirm with the findings of Allen (1977) that if distance between developers are 30 meters or kilometres, the effect is similar – reduced quality on communication. Ano8 further explains that developers, regardless of cultural background, tend to not show importance to informing about their status and progress, which may for instance cause that they struggle with an issue that may have easily been solved if they were discussed with others. The developers may think that they can inform the others after finishing their work, but this cause the others to not know the status of the module this developer is working on. This finding is similar to Parnas' claim that poor communication between developers is one of the main factors causing issues for the IT-industry.

When co-located, this challenge may be solved by just informally talking with the developers, but when there is physical distance, these issues may have greater impact on the progress, and even on the confidence among the team members. This is another example for focusing more on the individual differences among people rather than the cultural. The interviewee also notes that most of the people you are interacting with in India are developers, not managers, thus amplifying the effect of the issue that developers do not find giving status information as important as managers do. They also see the same problem among onsite resources, but it is not an issue at onsite because they sit in the same place and discuss during lunch.

Earl's (2001) KM schools and Hansen, Nohria, & Tierney's (1999) codification and perzonalization strategies for knowledge management describes the need to have intensives for knowledge sharing. In the perzonalization strategy the management should encourage high level of person-to-person communication by for instance including this as a factor that

defines the employee's bonus. Similarly, the cartographic school also dictate the use of such intencives to promote knowledge sharing.

Developers' lack of effort to reporting status is easily dealt with onsite because of nearness to the informer and receiver of information. Using coffee breaks, lunch breaks or other informal arenas to chat openly about status are satisfactory for the team lead to acquire the needed information. When this physical nearness is swapped with hundreds of kilometres in distance, arenas for informal talks are also changed with pure formal channels for communication. The importance of informal talks is further described and discussed in subchapter 5.5**.**

Uncertainty due to differences in national culture

Not knowing each other's way of being becomes an issue when one need to interact with the other person. Such issues may occur within one location if you have to interact with someone you have never met before, but when the interaction is across two different locations with very different national (or organizational) culture, this uncertainty regarding how to treat the other person is exacerbated. AD team lead, and offshoring lead for ProjO at NMO described this as:

> *If I have not met a person, I do not know if I ask this question or if I react like that, what will be the reaction of the other person. And that is one thing, which can happen both Indian-to-Indian, and Norwegian-to-Norwegian. But it adds up more uncertainty in case you are from different background, and you do not know what level they are in* (Ano8, Appendix B.7).

The same person tells that *more than cultural differences, it is the distance that makes people uncomfortable* (Ano8, Appendix B.7). This statement seems contradictory to the above one, but rather they should be interpreted as enhancing each other. Geographical distance introduces uncertainty because you do not know the person when communicating. Mitos has employees working in Bergen and Lillehammer, Norway, and dealing with these from Oslo, not knowing them in person, often introduces the same problems (Ano8, Appendix B.7). But when the geographical distance is accompanied with cultural distance, they reinforce each other, causing even more uncertainty.

Not having met a person in real causes difficulties understanding how he or she will react on your way of communicating. Confirm with the IMO resources to prefer email, and the statement that distance has more impact than culture, is the quote below, which describes the issue when not knowing the person you are to talk with:

> *If I have to call somebody in US, and I know he is a partner or something, I might have some restrictions (...). If I say something in a certain way he might not like it. If I met this guy, and I know how he reacts, what he likes or not likes, there will be no hitch next time if I have to ask him anything* (Ano8, Appendix B.7).

Another issue when working globally and not having a good view on each other's national cultures or way of being is misunderstandings or misconceptions. Ano8 in ProjO, who is of Indian origin, but has been working in Norway for several years, gave a hypothetic example:

> *If an Indian asks me in India, So, how is the weather? Is it sunny?, I will start laughing and think what kind of questions is that. We are used to having sunlight the whole time, so we do not ask similar questions. But, this question might be very important in European, or US terminology* (Ano8, Appendix B.7).

She explains that this may be a type of cultural difference, or an example that illustrates that people talk about what is unusual or lacking in their world, and in such cases people from different cultures tend to focus on different things.

Research literature, on the other hand, also show that there are some culturally dependent preferences for way of communicating. Krishna, Sahay, & Walsham (2004) describes that Indian companies treat Japanese and American clients differently regarding communication. Americans seemed to prefer written and explicit knowledge with informal telephone and email conversations, while the Japanese preferred more verbal and tacit contact with formal use of telephone and email. This observation is also confim with the critic of western managers' focus on primarily explicit knowledge, while the Japanese recognize the tacit knowledge as complementary to the explicit (Nonaka & Takeuchi, 1998).

Another source of misconceptions is the different body languages used in different cultures. When going around in Chennai with an Indian acquaintance for taking tourist pictures, I experienced problems interpreting simple nodding for signalling a *yes*. This friend of mine was to take a picture of me, and all I got from him was a nod when I asked if the picture was shot, causing me to ask him the same question twice or three times before I understood that this nodding meant yes. Although I had read that Indians might nod horizontally for signalling a *yes*[15], while that means *no* in the west, I experienced difficulties interpreting the nodding correctly.

[15] As a curiosity I want to mention that when yes-nodding, I noticed that the Indians move their head in a pattern like the symbol for unlimited, ∞, and not straight to the left and right.

The ProjO offshoring lead at NMO is of Indian origin, and she has been living in Norway for many years, thus giving her a good understanding of both the Norwegian and Indian culture. Much of the communication from IMO to NMO goes through such intermediaries, or *supplier manager* as they were called in the Siemens GSP (Sangwan, Bass, Mullick, Paulish, & Kazmeier, 2007; Mullick, et al., 2006). Another term, from Motorola, for such a role is *liaison,* and Battin, Crocker, Kreidler, & Subramanian (2001) state that *the liaisons provided the key link between the architecture team and the development teams (ed. thus cross-site link), as well as providing the US management team with a face to put with the non-US center* (p.76). Such use of native Indians as intermediaries in the IMO-NMO communication can make IMO resources feel more comfortable. In addition NMO resources will feel comfortable knowing "one of them" is at NMO making sure the communication goes well.

5.4.3 Language Diversity

The challenges due to different languages can be summarized to:

- Some documents received by IMO are in Norwegian.
- Implementing graphical user interface (GUI) elements, which are in Norwegian, is more difficult.
- Customer hesitates to use English, at least orally.

Documents in Norwegian

IMO was involved in the Desert projects in 2004, while NMO has been working with these projects many years before that. Therefore many of the documents were initially written in Norwegian because both customer and the service provider where Norwegians. After the offshoring of maintenance tasks to India, these Norwegian documents had to be translated to English so the Indian resources could read them. Over time, many documents have been translated, many new documents have been written in English, but still some documents, from both NMO (i.e. requirements specification) and customer (i.e. technical specification), are in Norwegian. This introduces unnecessary translation work.

IMO use both freely available Internet tools such as *TriTrans*[16] for translating from Norwegian to English. Documents translated by automatic Internet services can be used, but the quality is not good. In ProjS they have now also

[16] TriTrans is a translation service freely available at Internet. URL: http://www.tritrans.net/

hired an external company to do some of the translation work. Using external translators is of course costly compared to having the documents in English from the beginning, and such translation can have a deep impact on the implementation if the translation is not accurate. The documents often have domain specific words, and also much technical words related to IT, thus when translating them, especially by conventional translators, accuracy may be lost. When the translators totally lacks tacit knowledge related to the domain, interpreting the information is not easy, thus making it hard to express it with all its details in another language. None of the informants commented on the quality of the use of external translators though.

Informal talk with two employees at Mitos Norway, one of them being my supervisor, revealed that different groups of employees at NCom have different comfort level in oral English. Mitos has projects with NCom where the major part of the resources from NCom is relatively young people, and in these projects English is easy to use as the common project language for both written and oral communication. In other cases, such as the Desert projects in this case study, the NCom resources are often older people with high technical expertise. These people are more reluctant to use English as they have been using Norwegian as their professional language for decades.

Difficulties for Indians to implement GUI in Norwegian

In ProjO the IMO team some times has to deal with implementing graphical user interface (GUI), which is in Norwegian. In such cases, where they do not understand the Norwegian words, and they have little functional and domain knowledge, the implementation work is not easy. Team lead (and developer) for ProjO at IMO describes it this way:

> *All screenshots we get is in Norwegian because it shall be in Norwegian in the final product, but we do not understand much of it. We need translation to be able to understand what the different GUI elements mean. We use tools such as TriTrans to translate, and this is hard, because some times we misunderstand due to insufficient quality in the translation and lacking functional knowledge.* (Ano6, Appendix B.5)

For aiding in both understanding GUI-elements, and also understanding some typical domain specific words in Norwegian, the onsite team has developed a custom dictionary for NCom. Typical domain specific Norwegian words such as *konto* (account) and *kunde* (customer) are explained in this dictionary. Nowadays some offshore resources actually use these Norwegian terms even when communicating in English internally at IMO. This is maybe done due to practicality, but such shared use of terms can cause a better team feeling across countries. Communities-of-practice has a shared mental model, a world

view, and often have a great connection internally, a good team spirit. I do not argue that use of these Norwegian terms builds communities-of-practice, of course not, but such use of terms specific for one work area is often salient in such groups. Through an ethnographic study of restaurant workers, how they played and worked at the same time at the workplace, Fine (1988) shows how *idioculture* gives a feeling of belonging and security from the outside world. Idioculture is a term that is somewhat similar to communities-of-practice, it is a group of people with a shared mental model, and similar believes, behaviour, custom and rites(Fine, 1988). During my case study I did not find any such idiocultures across IMO and NMO, but I argue that use of Norwegian terms gives a better feeling of closeness to each other, thus better feeling of belonging.

Hesitation to use English

In ProjD, where IMO and customer communicate directly, the communication is mostly on written English because the client does not feel comfortable with oral English. This works well because similarly some, but not all, IMO resources prefer written communication rather than oral due to shyness or having a reserved personality. On the other hand oral communication is wanted sometimes because it is faster and you can clear up misunderstandings right away.

When the Indian resources are in Norway for knowledge transfer sessions or other reasons, they want to visit the customer to see how they work and interact with them directly. Some of the Indian informants who have been in Norway reported that some times they have not been able to have face-to-face interaction with the customer even if they were situated near each other in Oslo. The reason has been that the customer did not desire to meet IMO resources. The informants believed it was because many NCom employees did not feel comfortable using English orally. From their case study on another GSD-project, Herbsleb & Grinter 1999b, also found that non-native English speakers (German employees in this case) hesitated to speak English, and they were more comfortable using only written English.

In ProjS there are examples of meetings held in Norway between NMO and customer, where IMO resources took part through teleconference. The customer did not want to switch to English after request from both Mitos' offshore and onsite resources. Even though NMO tried to get customer to use English, so offshore resources could understand what is happening, the customer refused because of lack of comfort in using English.

In chapter 5.4.1 about challenges due to the chosen communication model, I discussed that when IMO is left out in the problem solving or requirements

gathering phase, it will be more difficult for them to internalize the information due to low level of shared tacit knowledge. Thus, IMO should take part in these phases along with NMO. The example above about customer preferring Norwegian, and difficulties getting the NCom resources to use English on meetings with IMO, reveals a great barrier to include IMO in the problem solution design and requirements gathering because of the natural high degree of customer interaction required by these activities. Such challenges will maybe have less impact over time when the customer gets more hands-on experience with working with global actors.

5.4.4 Trust and Confidence

The challenges regarding trust and confidence issues can be summarized to:

- IMO need to prove themselves over time, and good deliveries, to gain trust at NMO.
- Not having informal talks across sites cause trust issues.
- Customer may believe NMO is superior to IMO, thus having less confidence in IMO.

IMO need to "prove" themselves

In a way we have to prove for them (Ano7, Appendix B.6), a senior developer in ProjO at IMO tells, pinpointing that he feels that he had to prove himself to NMO to gain their trust. Similarly, several of the other resources in ProjO and ProjS report that NMO's confidence in IMO was low initially, but increased much over time. Both developers and resources in team lead and managerial roles report this across ProjO and ProjS. The ProjD team lead in India, on the other hand, has been satisfied with NMO's confidence and trust in offshoring resources from the early start. Another possible reason may be that ProjD got early responsibility for high-level work, which may have given a feeling of being trusted. Today, all informants are content with the level of confidence and trust they get from NMO, but they point out that the situation today is a result of time and continuously good deliveries that have proven to NMO that offshore resources are capable of delivering.

Similarly, in another case study, Herbsleb & Grinter (1999b) report they found that before cross-site visits, both sides had low degree of trust and confidence on each other and their work.

Informal talks

Being one of the main focus areas of this thesis, and due to its importance to many of the other challenges presented in this subchapter, the discussion around informal communication is thoroughly described in subchapter 5.5.

Customer believe IMO is second to NMO

One ProjS developer, Ano5 (Appendix B.4), mentioned two possible reasons for why the customer, NCom, may not want to deal directly with IMO. One reason was the customer's hesitation to use English, as mentioned in subchapter 5.4.3, the other explanation was that the customer may believe NMO was superior to IMO in one or another way. The interviewee did not give any further information about why the customer could believe such a thing, but I make some assumptions about possible explanations:

- Physical and cultural distance between customer and IMO cause the customer to trust IMO less than NMO.
- India being a developing country can make it hard to believe they have capabilities comparable with westerners.

The research literature also describes that western employees often underestimate their counterparts in low-wage offshore locations (Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006; Battin, Crocker, Kreidler, & Subramanian, 2001).

5.4.5 Knowledge Distribution

The challenges regarding the uneven knowledge distribution can be summarized to:

- IMO does mainly work related to coding and unit testing, giving them less domain and business knowledge. The Indian resources also have poor overall picture due to lack of participation in early phases.
- Few SMEs in IMO cause IMO to depend on the SMEs in Norway.
- IMO use more time than NMO to acquire functional knowledge.

IMO is the lowest link in value chain

In ProjO and ProjS, IMO does mainly coding, unit testing and system testing. Several of the interviewees from these projects pinpoint their low level of functional and domain knowledge. The processes surrounding the offshoring model in these two projects, where NMO is the middleman in most of the communication between customer and IMO, cause IMO to have little access gaining more domain knowledge. An example of such a process is bug fixing: The defect is solved by onsite, offshore only code and tests it for NMO, giving them less possibility to gain more business and domain knowledge. Team lead in ProjO at IMO clearly states this point:

> *I don't say we would design better solutions, but maybe sometimes we could have made better solutions, if we were involved in the problem resolving activity. By only coding a solution made by NMO, we won't*

> *get more business understandings or better functional understanding of the solution* (Ano6, Appendix B.5).

It should be noted that ProjD does not deal with this issue, as they have direct contact with the client in Norway.

In addition to express difficulties acquiring business knowledge, the quotation above also states that by not including IMO in the solution design phase, Mitos may slip on a better solution. This latter point is important to understand the next challenge, namely that of few SMEs in IMO.

Knowledge is created through social interaction between tacit and explicit knowledge (Nonaka & Takeuchi, 1998). A case study at Alcatel reports that *achievements are substantial if engineers of entirely different educations and cultures try to solve problems* (Ebert & De Neve, 2001, p.68). By not including IMO in these early phases, some innovative solutions may never be brought to life, and knowledge would not propagate on the ontological dimension of the knowledge creation spiral presented in chapter 3.3.3. Organizational knowledge creation is thus limited to some extent by not including IMO in the more knowledge intensive work assignments.

Few SMEs in IMO cause dependence to NMO

It was not possible to get numbers on the exact amount of SMEs at IMO and NMO, but according to several interviewees, there is lack of SMEs at IMO. The knowledge transfer plan (which is not presented in this report due to confidentiality) reveals 15 of 19 SMEs in ProjO are Norwegians. I found 19 SMEs on the project's SME list, of which 15 had Norwegian names, whether they work in Norway, India or any other place is unknown. As mentioned above, when IMO does not take part in the solution design or other work higher in the value chain (requirements analysis, architecture etc.), which is work dealing with business drivers and domain knowledge, then it is not easy to develop more knowledge on these areas. Thus, making IMO having few domain or business experts.

When IMO gets a change request, we think <u>what</u> shall be changed; we do not think <u>why</u> shall this be changed (Ano6, Appendix B.5). This quotation briefly explains the differences in the way IMO and NMO thinks, and the type of work that is assigned to each of these sites. By often thinking *what* shall be done, IMO develops expertise in technologies and programming languages because they will be doing routine work. At least, the work assigned to IMO will be felt as routine work if they do work that is similar for a long time. Often developers tend to prefer learning new features and new technologies,

they do not want to be experts in one thing (Desouza, Awazu, & Baloh, 2006), and the interviews conducted with the developers in India supports this.

Cross-site modularization of work was identified as one of the benefits of GSD, because then there will be less need for cross-site communication. Chapter 2.1 argues that diminishing the need for cross-site communication is vital, but at the same time one should be aware that too much independence causes integration difficulties of software, and less team-feeling across sites. The dependence on NMO SMEs, cause much cross-site communication, and although it may build relationships across sites, I doubt the extent of team-feeling building by such questions to SMEs. If the communication was between peers co-operating, rather than a novice asking a teacher, it may be a better chance of building a good cross-site group feeling. Thus, this dependency seems not having any specific positive effects.

Longer learning time in IMO

Ano7 (Appendix B.6) clearly states the difference in amount of time that takes to acquire functional knowledge in the different locations by saying *1,5 years in NMO is comparable to 2-3 years in IMO*. Although the numbers may be different from the truth, it is at least clear that there is a difference in the learning time, not in IMO's favour. The extra amount of time required in IMO can be explained by the smaller amount of exposure to functional info at IMO. NMO's direct and frequent contact with the customer, and their capability to speak Norwegian, make it possible for them to acquire more functional knowledge in a shorter time.

Also, when the knowledge of the resources at IMO is very similar to each other, it is less likely that they learn new features from their local colleagues. Ano6 (Appendix B.5) identified this by saying *everybody knows what everybody knows here at IMO*. Knowledge sharing happens best in local groups with close working relationships because it is easier to accomplish tacit to tacit knowledge transfer, socialization, in such settings. Also, knowledge artefacts created by people you know, and who works in your team, are often the type of information preferred by individuals (Desouza, Awazu, & Baloh, 2006). Thus, two possible explanations for the longer learning time, in addition to the obvious lack of nearness and language capabilities, can be that the major part of the experts in the domain are abroad, and that individuals tend to prefer learning from their own team members and others in close working relations – which is difficult when *everybody knows what everybody knows*.

Once again, the degree of shared tacit knowledge plays an important role. Physical and sociocultural distance cause the tacit knowledge shared by the

Norwegian stakeholders NMO and customer on one hand, and IMO on the other hand, to be low initially. Over time domain knowledge is transferred through much externalization from Norway, and interpreted at India through internalization. This builds the tacit foundation needed at IMO for a more efficient interpretation process of the information from Norway. Thus, recognizing the need to build up the tacit foundation is crucial to decrease the learning time at IMO.

In addition to visiting each other, Mitos has developed *New Joiners Kit*, which is a set of documents with overview information, videos from presentations held by SMEs, screenshots and voice recordings from meetings etc. This kit is used both at NMO and IMO when the project teams get new staff members. In this way they can ensure that the new joiners get a quick introduction to the project at the same time as getting deeper knowledge through the SME-presentations, without too much effort from the existing team members. Often the size of the teams changes and increases over time, and by using the New Joiners Kit they are prepared to handle these changes in a structured way. Creating the New Joiners Kit ensures that there is a focus on knowledge transfer from early in the life of the project. The practice of New Joiners Kit has also been transferred to other projects because it was successful. Such a solution, with use of video, voice and textual presentation gives the new joiners different ways for internalization. Although, without much shared tacit knowledge it may be difficult interpreting and get a holistic view of the project, by offering multiple channels of externalized information, the internalization process may be easier.

5.4.6 Strategic Issues

Challenges regarding the strategic choices done by Mitos can be summarized to:

- Lack of technical career ladder at IMO causes people with technical expertise sitting with managerial work.
- No plans to assess the resources involved in KT after the KT-session.

Technical career ladder

At IMO, technical resources that have been working for some years become managers or get other type of managerial roles such as team lead, project lead etc. This is the common Indian career ladder, so it is not anything special to Mitos. Such use of technical experts is a form of misuse of expertise. Also, if people like technical work, they may find it rather boring doing managerial duties. At Mitos Norway it is possible to have a technical career ladder where

a technical expert may earn equal to a manager with the same seniority, making both career ladders regarded as equal.

According to Ano6 (Appendix B.5) technical staff that wants to continue with technical work year after year should do that and get the promotions within his technical role. The salary should of course also mirror similar managerial roles and depend on seniority. The system at IMO should be similar to those in other Mitos offices in other countries such as Norway. I also recommend this, and it is not purely based on a humanistic view, but also economically it would be wise to keep domain experts in their technical roles. As explained in the previous subchapter, the learning time at IMO is slower than at NMO, making it hard to build a base of experts at IMO. India has a high level of employee turnover in the IT-industry, though according to a manager (through informal talk) at NMO, Mitos India has an attrition level below the average of their competitors. The attrition level, lack of technical career ladder, and long learning time, can be three reasons for why there are few SMEs at IMO.

No plans to assess results of knowledge transfer-session
Knowledge transfer (KT) sessions happen whenever needed, on ad hoc basis, and when new features are to be added to the systems. An SME at NMO holds a presentation through videoconference, or by visiting offshore location, or when a group of offshore resources visit onsite location. Such sessions are appreciated by the IMO resources because of its usefulness for a rapid ramp-up of knowledge required to be able to finish the work assignment. However, one team lead expressed that there are no plans to assess the resources involved in the KT-session (Ano2, Appendix B.2). By not verifying what kind of knowledge was acquired by the participants, it is not easy to know how to improve the KT-sessions to come. A type of post mortem analysis (PMA) should have happened after such KT-sessions, so that pros, cons and other issues of the KT-session could be discussed and assessed systematically. Desouza, Awazu, & Baloh (2006) describes the neccessity of PMAs:

> *Unless they (ed. organizations) systematically conduct post mortems, organizations face enormous costs from needless rework and the unnecessary, time-consuming repetition of mistakes* (p. 36).

5.5 GSD's Impact on Informal Communication

Research literature (Herbsleb & Grinter, 1999b; Herbsleb & Grinter, 1999a; Heeks, Krishna, Nicholson, & Sahay, 2001) pinpoints the importance of informal communication in software development. Mullick et al. (2006) state that they *underestimated (...) the extent to which ad-hoc interactions can fill*

the gaps and resolve the conflicts left by ambiguous specifications, misunderstandings and poor planning. The introduction chapter described poor communication as the main contributor to the challenges faced by the software industry. These challenges include delivery slips, poor software quality, high degree of ripple effects when modifying the software, and poor maintainability. Also, both the introduction chapter and chapter 2 argue that it is the same communicational challenges that cause concerns in a global software development, but they are exacerbated due to physical, socio-cultural and temporal distance. The importance of informal communication, along with the fact that poor communication is undermining software development projects give raise to this analysis of GSD's impact on informal communication.

Although not a definition, Herbsleb & Grinter (1999b) gives a description of the nature of informal communication:

> *Informal communications channels are outside the official reporting structure of a project. They are simply developers' access to other developers, managers, testers, and anyone else they need to interact with during the development process. (...) they are usually invoked by those doing the work, without requiring management authorization, and perhaps without management's knowledge* (p. 86).

They argue that informal communication is an important complement to explicit and formal communication and coordination channels. Informal communication is used to *fill in details of work, handle exceptions, correct mistakes and bad predictions, and over time manage ripple effects of previous decision and actions* (Herbsleb & Grinter, 1999b, p. 86).

My own experience from several development projects at my University and from summer internships supports that informal communication is an important coordination mechanism. Especially, handling the ripple effects of new decisions effectively is easier with informal talks: At a summer internship, in a hectic test-phase with up to 10-15 deployments to the test environment during one workday, I found informal shouting to be very useful. I was the responsible for deployment in a project with 13 resources, and initially I sent emails to everyone prior to each deployment, but found this to be a slow mechanism for informing everyone. Because everyone was situated at the same location, I started just loudly announcing that one deployment is to happen. Similarly, my experience from the same internship is that informal talks around the coffee table with people developing other modules were very important for solving integration issues. It is just faster, easier, and you know that the receiver of the information has got it.

Let us turn from my experiences to this case study. Several of the challenges described in the previous subchapter deals directly with informal communication:

- Status reporting among developers
- Uncertainty due to differences in national culture
- Lack of informal talks

But also other challenges, such as those regarding trust and confidence, suffer from lack of informal communication, at least to some extent.

It is rather easy to understand that with physical distance, the possibilities for informal talks decrease. Social gatherings after work, lunch breaks, and coffee table talks are examples of informal arenas where much information is shared (Herbsleb & Grinter, 1999a), but none of these can be accomplished when several hundreds of kilometres are between the teams. Orr's famous empirical study of copy machine repairmen's way of working (1990) describes how informal talks and information sharing is vital, and even more vital than the formal official routines set by the management. Such informal communication is necessarily harder to achieve when the employees are globally dispersed (Herbsleb & Grinter, 1999b; Desouza, Awazu, & Baloh, 2006; Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006).

Herbsleb & Grinter (1999a; 1999b) conducted a case study at Lucent Technologies where they observed a project with teams distributed in UK and Germany during integration phase. The focus of this study was how architecture, coordination and distance affect each other. Their findings reveal the great importance of informal communication, also in a GSD setting; and that lack of good mechanisms for informal talks caused the following challenges:

- *No unplanned contacts.* Unplanned meetings often cause people to share much non-relevant information, but also some project-relevant information that is crucial for smooth coordination of a project.
- *Not knowing whom to contact.* Developers reported difficulties knowing whom to contact on the other site for issues.
- *Difficulty of initiating contact.* Time differences, not knowing if a person on the other site was busy, and not have met the person before, were some of the reasons for this issue.
- *The ability to communicate effectively.* Unless co-located, collaboration requiring studying or discussing documents together is difficult because of not being able to point and discuss. Use of collaboration technologies helps, but then the problem is that non-native English speakers did prefer written communication when using English.

- *Lack of trust.* It was a great deal of lack of trust initially due to fear of loosing own jobs, causing them being reluctant to share information. Trust improved over time after visiting each other.

Earlier, in chapter 5.4.2, I presented an issue regarding developers not understanding the importance of status informing. The informant who brought that issue to light also described how the globally dispersed sites cause difficulties solving this problem:

> *Sitting on the other side of the globe (ed. in Norway), you think nobody is working on the defect (ed. in India), but that is not true. It is just that this guy (ed. developer) did not feel like informing about this. But if the same guy is sitting next to me, I will go in the morning and ask him. And he will tell me, so confidence and trust develops with this co-located guy. But when he is not sitting next to you, and that person do not feel the importance of communicating to you, then you feel that things are not working. I think the importance of the flow of information and communication is something you have to explain to the developers, both onsite and offshore* (Ano8, Appendix B.7).

In this example the interviewee describes the solution often used when encountering issues like developers that do not inform about status, namely having an informal talk with the developer asking for status. As she describes, such action is harder to take when the developer is residing on the other side of the globe. In circumstances like this, the result is often that one site thinks the other site is not doing their work, causing less trust and confidence in the other site. This is an example of how a personal factor such as reserved personality, or being a person not fully understanding the necessity of informing about progress, which is already a problem in co-located projects, can have amplified importance and cause more trouble when the teams are globally distributed.

The diminishing trust and confidence play important role in the type of responsibilities one gets. When confidence and trust in the offshore team is lacking, onsite may start micromanaging all activities at offshore site, which is exactly what happened early in the Desert projects. In the early days when Desert projects were offshored to India, the onsite team lacked trust and confidence in offshore team, causing them to micromanage activities at IMO. Over time the confidence level increased, and less micromanagement happened. None of the informants in India liked being micromanaged over time; most of them felt the need to be micromanaged early because that was actually helping them when they lacked knowledge about NCom and the project; later in the project, when their functional understanding increased,

they wanted more room for decision-making themselves, and felt micromanagement as unnecessary.

It is vital knowing both that IMO resources, regardless of their role, dislikes micromanagement from NMO when not needed, and that personal factors in a global setting can cause trust and confidence issues, especially when there are limited informal communication. These circumstances can again cause onsite to micromanage offshore resources. Not recognizing these factors may cause conflicting situations across sites where none of the sites understand the behaviour of the other. Only when onsite feels comfortable with the offshoring practice and has confidence in the offshore sites' capability to deliver, will they feel real ownership in the offshoring model. The Norwegian offshoring lead for ProjO describes that when the ownership is taken care of, that itself removes several problems:

> *It is just ownership. I feel if you have ownership from onsite to do offshoring... Believe me, you will have less hazards and less problems and less issues* (Ano8, Appendix B.7).

Based on the case study, Figure 5-1 shows the kind of influence lack of informal communications can have on the overall project. As described above, lack of informal communication between NMO and IMO causes NMO to some times have low degree of trust and confidence in IMO, which again cause NMO to micromanage IMO. This micromanagement causes IMO resources to be dissatisfied with the situation and they feel little ownership, which again cause NMO to have trust issues towards IMO. Now, the initial lack of informal talks have started a circle of behaviours at both NMO and IMO, which can iterate several times, and only contribute to a negative development in the relationship between these two sites.

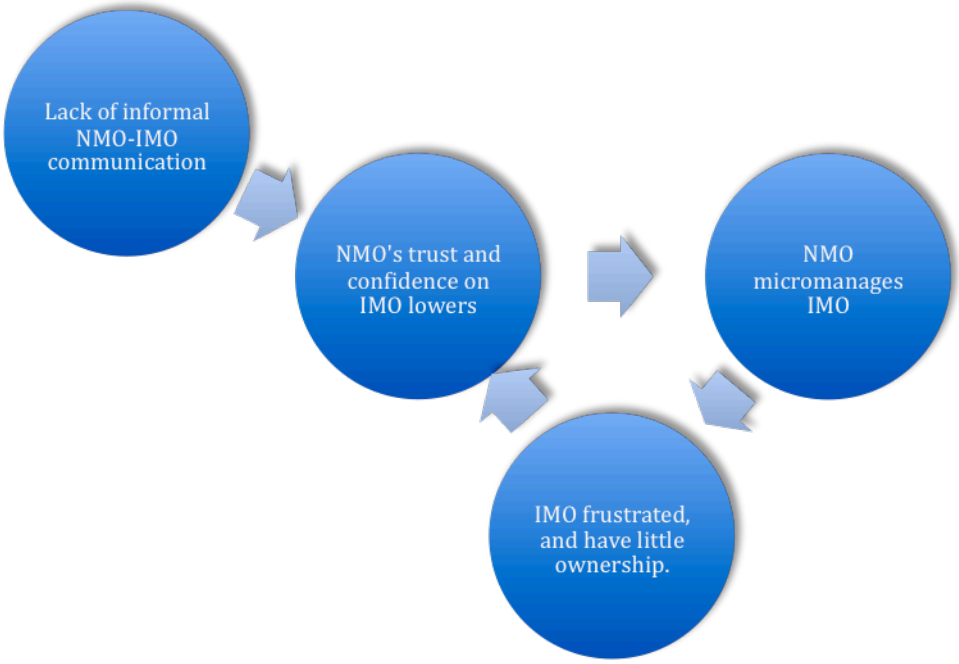

Figure 5-1: The influence of lack of informal communication

The following text describes my thought on how to alleviate the consequences of lack of informal communications across sites, by suggesting ways to improve such communication.

5.5.1 Possibilities for Improving Informal Communication Capabilities in GSD

In *The Interpretation of Cultures* (1973), the renowned cultural anthropologist, Clifford Geertz, states *Nor (…) have I been impressed with claims that structural linguistics, computer engineering, or some other advanced form of thought is going to enable us to understand men without knowing them* (p. 30). This quotation describes some of my own claims in this subchapter, namely that one need to *know* each other to be able to understand one another, a task that is inherently difficult if great socio-cultural distance.

It is rather obvious that the level of formality in the way a person talks to another depends on how well they know each other. For instance, if you have your lunch with people you have met before and know well, you talk more, and with less formality, than with someone you have only met once or twice. Heeks, Krishna, Nicholson, & Sahay (2001) argue that informal communication was only observed after participants had physically met and built relationships. So, by increasing the level of personal relationships among

developers you can promote more informal communication in informal arenas. My suggestions for how to increase the level of informal communication in GSD is based on that if people know each other well and have an arena for informal talks, such talks will happen. There exists empirical evidence (Herbsleb & Grinter, 1999b) for such a claim.

The first step is to get people to know each other, and when people are globally dispersed, this is a difficult aim. Face-to-face meetings can ease the process of building personal relationships (Heeks, Krishna, Nicholson, & Sahay, 2001). This is one of the advantages of communities-of-practice, because people work close together and have frequent interactions, both formal and informal. In a conference setting, being academic or corporate, the evening is often set off for eating dinner, having something to drink and small-talk. And through this small-talking you are supposed to build your network of people and to get to know each other. My experience is also that in all conferences or seminars I have been to, this small-talk session in a very informal setting, is the best way to get to know each other on a shortest possible time. Jensen, Menon, Mangset, & Dalberg (2007) report from Schlumberger that cross-site visits with dinners and other shared activities promote building long lasting personal relstionships accross sites. They also note that such relationships build *a loyality that affects the long term performance of the outsourcing engagement*.

So my suggestion is that visiting each other should happen. This is expensive, and Mitos need to consider the economic part of this suggestion, which is outside the scope of this thesis. When visiting each other, one should maximize the outcome of it, which is also wise economically. The small-talk setting should be used: a very informal place such as a restaurant in the evening, where project members from both sites meet to share stories, talk about whatever they want and just have fun, is such a setting that promotes building personal relationships. For instance, my experience is that in Asian countries like India, Sri Lanka and Pakistan, inviting people home for dinner is very common. Also, Shukla (2007) describes that westerners should not be surprised if Indians, even minor acquaintances, invite them home for dinner. One of the Indian resources I interviewed actually told he has been at Ano8's home in Norway for visiting. If IMO promotes such behaviour when Mitos' Norwegian employees are visiting IMO, the home visit would be an informal arena where the Norwegian and Indian resource may get to know each other. In addition this would be a setting that is comfortable to the Indian resource as it is close to their customs; for the generation Y (Trunk, 2007) employees in Norway, it will be an interesting and exciting experience. Also, the visit should happen early in the project life to be able to benefit from the personal relationships as early as possible (Herbsleb & Grinter, 1999b). When

companies from the IT-industry have their company presentation at NTNU, they often promote themselves as companies with an international profile, and with possibilities for travelling and have an international career. This way of attracting students reveals that the companies have understood generation Y, and I think my suggestion is just an addition that will attract more students, at the same time as contributing to better cross-site relationships, thus promoting informal communication.

In Desert, there have been several cross-site visits. Five of the seven resources in India, whom I interviewed, have visited Norway once. Two of the visits were kick-off meetings for the projects, one visit was in relation with a new large change order, one was due to interact with the customer because of a new analysis project, and the purpose of the last visit is unknown. Four visits were in the initial phase of some part of the project, thus giving possibilities to benefit from the visits throughout the whole project. In ProjD, out of the eight IMO resources, four have visited the Norwegian office, and Ano3 (Appendix B.3) reports that these resources are more confident talking with their Norwegian peers, and have a better understanding of the organizational culture at NCom than the four who did not visit Norway.

The steps described above promote building personal relationships, but still arenas for informal talks over distance are very scarce. My suggestion is to use a project-internal chat, a chat room where all project members can log on, a type of virtual office room. Here, each project member can choose to talk directly with a given number of people, to the whole project, or to specific groups within the project. Herbsleb & Grinter (1999a) suggest that tools for communicating in distributed settings should show people's availability, show who knows what and promote spontanous ad hoc communication. Considering time differences, such tool should support both synchronous and asynchronous communication. The chat program should therefore promote being informal, by i.e. having smilies, profile picture etc.; it should show peoples' roles, group belongings and expertise (a personalization strategy), and a way of showing their availability. In my suggestion, all project members should be available through this chat program, similar to Mitos' practice of being available through email programs throughout the workday. A case study at Siemens reveals that project-intern Internet forum served the purpose of cross-site communication with less formality, and the discussed issues could be stored in a structured way for later use (Sangwan, Bass, Mullick, Paulish, & Kazmeier, 2007; Mullick, et al., 2006). Finding out if such an application exists, or need to be custom made, has not been within the scope of this thesis, and therefore I have not done any research regarding tools to aid distributed software development.

5.6 Chapter Summary

This chapter described Mitos and the Desert project portfolio with the three projects in focus, ProjD, ProjO and ProjS. Observations from India and IMO were given to contextualize the case study, and to put the case in a socio-cultural setting. The results were presented in a structured manner, along with a discussion on the findings based on knowledge management concepts wherever it was suitable. These findings are summarized in Table 5-4 , where challenges and their solutions are presented. Throughout the discussion, empirical findings from other researchers in other organizations were used to place my findings along with the already existing research literature.

Table 5-4: Summary of challenges met, and solutions implemented by Mitos

Challenges	Solution
Communication model	
Using NMO as middleman delays, and cause mismatch in the original and received message.	In smaller, less complex projects where customer is used to English, as in ProjD, the use of middleman is low. Emails and summary of discussions are used to document interaction.
Personal and cultural factors	
Shyness and reserved personalities, uncertainty due to cultural diversity.	Visits to get to know each other, use of Indian intermediates, some cross-cultural teaching, and use of informal talks (in co-located setting).
Language diversity	
Documents in Norwegian, difficulties interpreting text on GUI elements, hesitation to use English.	Use of automatic Internet translators, hiring external translators, use of custom made domain and customer specific dictionaries.
Trust and confidence	
IMO need to prove worthy of trust, customer believe IMO second to NMO	Time diminish the trust and confidence issue, along with IMO's good deliveries.
Knowledge distribution	
IMO does mainly coding and unit testing, few SMEs at IMO cause dependencies to NMO, longer learning time at IMO.	Tries out giving IMO responsibilities for more high level phases in ProjD. New Joiners Kit to improve learning time for new joiners.
Strategic issues	
Lack of technical career ladder, no plans to assess results of KT-sessions	The case study did not reveal any approaches by Mitos to overcome these challenges.

In addition to the challenges presented in the above table, issues related to lack of informal communication due to physical, socio-cultural and temporal distance were discussed. An approach to increase the level of informal communication is suggested, though it was mainly based on my ideas and thoughts, as I was not able to find literature discussing this issue the way I was looking for. My solution does not include any technical tools because it is outside the scope of this thesis, though some requirements to such a tool is suggested, once again only based on my thoughts.

Another issue was revealed long after data collection, and it falls outside the different groups of challenges presented in chapter 5.4, so I give a short description of it here. During data collection I suspected that the strict environment where different projects had different areas at IMO's office caused that some redundant work had to be done. For instance if ProjO found a good solution for interacting with legacy system X, and ProjS also needed to do so, it would be easier to reuse ProjO's solution, or at least consult the solution designer at ProjO. Though an obvious advantage, none of the informants found the strict environment to be a problem, even after I described a situation where sharing knowledge across projects would be beneficial, the informants found the present situation to be sufficient. No documents are shared across the Desert projects, but when there are technical issues they use to talk to each other informally. Several weeks after the interviews in India, I was informed that IMO had designed a cross-project document showing the interrelationships among the different Desert systems. Thus, somehow, IMO had realized a need for such inter-project level communication, or at least knowledge about the other systems functions.

5.7 Validity and Generalizability

Invalid data

Deliberately giving false information may be a great problem. An easy to understand case where this may happen can be when a group of developers are asked about how they follow internal methodologies. It is quite obvious that they may want to tell that they have followed the methodologies even though they did not, because they know that their superiors may read the report. Own beliefs, exaggeration, bad memory are among factors that may cause the interview subject to give false information, intentionally or not.

Set of informants unbalanced
The data collection is unbalanced in the set of interviewees, hence the results may be biased. All interviewees were of Indian origin, including the only person I was able to interview in Norway. The IMO-NMO ratio in the number of interviewees was 7:1, which is very uneven. My supervisor chose the interviewees, thus not randomly picked. Also a third stakeholder, the customer, is of great importance because many of the challenges are regarding their reluctance to use English, and they have not been interviewed. Thus, there is a bias towards the Indian view of the offshoring relation. The research literature is rich on case studies done at western locations (Sangwan, Bass, Mullick, Paulish, & Kazmeier, 2007; Ebert & De Neve, 2001; Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006; Mullick, et al., 2006), so focus on the offshore site, especially with great sociocultural distance to onsite, should also be studied. Nevertheless, the bias in this report towards an Indian view should be noted.

Quality of interviewer and the interviews
In the benefit of hindsight, I see that my capability to ask the right questions and focus on the right information may have been better if I had done more interviews before. This lack of experience in doing interviews in relation with case studies is a limitation in the sense that the collected data may have been better with more experience. After the first few interviews, I felt more comfortable with the interviewing situation, and I believe that made the interviews better because I was able to process the input from the interviewees better at the same time as taking notes.

I wanted voice recording, because then I may concentrate more on the interview, try to follow the logics of the interviewee and find good follow-up questions. Also a voice record of the interview is good for the transcribing process and to find new questions of interest after the interview. During data collection I had to realize that at IMO voice recording was strictly prohibited. Therefore my notes were the only recordings I got from seven of the eight interviews. Not being an experienced interviewer, having limited knowledge about the case organization and the case of interest, it was not easy to both write notes and listen to the interviewee at the same time as processing the information and find interesting areas for follow-up questions.

Suggestion of solution
The suggested approach to increase informal communication across sites is mainly based on my thoughts, and I have only used a few supporting sources as I was not able to find many suitable sources. Thus, the credibility of my claims can be questioned and there should be done more research to support or falsify these claims.

Summarizing validation and generalizability

The validity of the findings have the above mentioned issues regarding invalid data, unbalanced set of informants regarding location, and I also argue that my own lack of experience in doing interviews and case studies contributes negatively to the validity of this thesis. On the other hand, efforts to increase the validity have been done by trying to follow the seven principles for interpretive field studies (Klein & Myers, 1999). How this is done was discussed through the assessment of research conduct in chapter 4.6. Trying to strengthen or falsifying findings by triangulation, giving much context information and even distribution of roles in the set of interviewees are among the actions taken. To reveal misunderstandings by myself, all transcripts were modified until approved by the interviewee.

Generalizability is always an issue in case studies. Abstracting and making concepts out of findings should be done for generalizing case study findings (Klein & Myers, 1999), and this is done by lifting each finding from a single incident level to a higher level of abstraction in the discussion. An example of this: single incident level - coffee table talks help getting status information from developers; abstract level – informal talks as a means of coordination. Also there has been substantial effort on linking these findings to findings from GSD literature, and to explain the findings through knowledge management concepts wherever it was natural to do so.

6 Conclusion

The purpose of this study has been to investigate knowledge managerial challenges in global software development projects, and industry approaches to overcome these. An empirical study with case study approach has been used to study GSD-projects in real life. Let us recall the research questions:

> *What are the knowledge managerial challenges in global software development, and what approaches are implemented by the industry to overcome these? How can these challenges and solutions fit into existing knowledge management theories and concepts, and what is the role of informal communication in a global setting?*

Conducting this case study at Mitos has not been easy due to late initiation caused by a lengthy discussion about research questions. Also, as often common in studies requiring close interaction with corporations, there have been coordination issues. Even with a short data collection period, eight in-depth interviews, tens of email correspondences with follow-up questions, and informal talks with several sources at NMO served as sources for acquiring information. Observations, mainly from India, but also some from Norway, have been described to give context, and also because some of the information is directly related to knowledge sharing.

The observed challenges were grouped into six categories, and some of Mitos' approaches to cope with these issues were presented. These challenges and solutions were summarized and presented in Table 5-4, and the main challenges can be further summarized into these three issues:

- **Mainly coding and unit testing in India.** This work distribution causes long learning curve for IMO. They will have difficulties building *domain knowledge* due to lack of shared tacit knowledge, difficulties internalizing due to distance and limited shared mental model.
- **Difficulties due to customer's reluctance to use English.** Language reveals itself as an important factor for not using IMO in much of the early phase work. Customer seems to prefer using Norwegian, which is an aspect outside the control of Mitos. Documents and meetings in Norwegian are additional issues caused by the language barrier.
- **Lack of informal talks across distance.** This is a challenge with great implications because *informal* communication is a crucial coordination

> mechanism, but difficult to deal with due to its root cause, namely physical distance. Informal talks are a coordination mechanism that is invisible in the sense that it is not planned and documented, it just happens. In addition to being helpful in coordinating the project, it also builds relationships, and promotes knowledge sharing and innovation. However, it is difficult to facilitate such informal talks in a global setting.

A concluding remark can be a statement made by a team lead in India: *I am in an imaginary world, where I have not met the people I create system for, and I don't even have a very good understanding of the domain of functions I am creating* (Ano6, Appendix B.5), denoting lack of domain knowledge due to working mostly with coding, and having little formal and informal customer interaction. Thus, the quotation describes the three main issues implicitly.

The main impression is that Mitos is a mature organization when it comes to conducting software development with globally distributed teams. Earl's (2001) *engineering school* of knowledge management enforces the use of methodologies and processes to aid in daily work, and such processes have been developed and used over several years at Mitos. Many sources (Conchúir, Holmström, Ågerfalk, & Fitzgerald, 2006; Mullick, et al., 2006; Sangwan, Bass, Mullick, Paulish, & Kazmeier, 2007) argue that *visiting* each other is crucial to be able to conduct software development with distributed teams. This case study reveals that majority of the Indian informants have visited Norway, and there are also often Norwegians in India. In addition, *intermediaries* with cross-cultural experiences are used to diminish the socio-cultural distance. The main impression among many informants is that the communication and co-operation between NMO and IMO is good; some initial *trust* issues caused problems, but over time, when relationships developed over national boundaries, this problem had less impact.

This case study differs from many other studies in respect to a few aspects: it deals with three-node communication, while others mainly deal with two-node communication; it gives the Indian point of view, rather than the western; it uses knowledge management theories more extensively; it uses findings from famous anthropological work in the discussion. These contributions are useful to enrich the field of information systems and broaden our view, and I have here shown an example of their use.

Using knowledge management theories was a crucial part of this thesis. Although not all challenges were easy to explain with KM-theories (here, research community should look into concepts from other fields like social and business anthropology, psychology and sociology), the theories were

essential for explaining *why* different issues occurred rather just explain *what* happened. Especially, recognizing *tacit knowledge* in the discussion proved to be useful for stating reasons for challenges, and to describe *internalization* and *externalization* processes across sites.

Through this study, I have revisited challenges already known in the research literature, in addition to identify new ones. Giving *historical*, *contextual* and *processual* information, and use them in the analysis along with the knowledge management theories, rather than only state the challenges and solutions, made it possible to get a better interpretation of the case.

7 Further Work

Some of the validity issues presented in chapter 5.7 dictate that future work should include making the set of informants more balanced. So, strengthening or falsifying the findings in this thesis should be done with more interviews with the customer, NMO and IMO. Customer's reluctance to use English actively, at least orally, is one of the main causes for several of the challenges met by Mitos. Hence, it is important to get their view on the case, as there may be unknown or unexpected reasons for their behaviour.

Chapter 5.5.1 may seem superficial in the sense that my suggested approach for alleviating the difficulties of informal communications across sites is mostly based on my thoughts. The given reasoning is mainly a logical discussion, which tries to support my claims by using common sense and some usual industry practices; very few scientific sources are used because of difficulties finding the type of articles I was looking for. Thus, as part of further work, my suggestions for improving informal talks should be empirically validated, or falsified. Also, maybe fields like psychology or sociology may have some useful answers regarding this issue. Tools to support informal communication across distances is also interesting future work.

Also the chosen knowledge management theories can enforce certain explanations, while other KM theories may explain the challenges differently. The reasons for choosing the KM-theories in this report are my impression that they suited my case, and that these are mentioned in the GSD literature that deals with knowledge management. Different theories may explain the findings differently, causing different conclusions. Other theories may also dictate different solutions. Hence, using other theories and frameworks within knowledge management may be useful for getting a different view on the challenges, and they may also reveal other areas to focus on when trying to improve the knowledge transfer between the two locations.

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Appendix

Appendix A Interview Guide

A.1 Interview Questions to Mitos' Indian Employees

1. Please tell a little about the project.
    a. Length, nr of people and teams, complexity, customer, system to develop etc.
    b. Your role?
2. Please tell how the project was organized.
    a. What organizational model?
    b. Demography: junior/senior, experts in Norway or India?
3. How were the knowledge management and knowledge transfer?
    a. Personal relationship between India and Norway or customer?
    b. Methods and technology used for KM?
        i. Worked/not worked? Wishes? Modifications? Video, chat?
    c. Any visit to Norway? Norwegian project members to India?
    d. Where were the experts? How was the functional understanding of the case in India?
    e. How was documentation conducted, materialized and distributed?
        i. Any common project space for sharing docs?
4. How was the Norwegian project management, and Norwegian teams?
    a. Misunderstandings, less respect, underestimating Indians?
    b. What was good/bad?
5. Positive or negative?
    a. Pos: What did you like? What worked? New solutions for problems?
    b. Neg: What was hard? What did not work? Any problems?

A.2 Interview Questions to Mitos' Norwegian Employees

1. Please tell a little about the project.
    a. Length, nr of people and teams, complexity, customer, system to develop etc.
    b. Your role?
2. Please tell how the project was organized.
    a. What organizational model?
    b. Demography: junior/senior, experts in Norway or India?
3. How is the communication (knowledge transfer) between Norway and India?
    a. Personal relationship between India and Norway or customer?
    b. Methods and technology used for KM?
        i. Worked/not worked? Wishes? Modifications? Video, chat?
    c. Any visit to India?
    d. How was it to have Indians here?
    e. How was the functional understanding of the case in India?
    f. How was documentation conducted, materialized and distributed?
        i. Any common project space for sharing docs?
4. What do you think about the Indian teams' performance compared to you?
    a. Misunderstandings, less respect, underestimating Indians?
    b. What is good/bad?
5. Compared to co-located teams in Norway, what is the difference?
6. Me as SME or project lead in India. Would you call me or email me?
7. Positive or negative?
    a. Pos: What did you like? What worked? New solutions for problems?
    b. Neg: What was hard? What did not work? Any problems?
8. Questions related to findings from India:
    a. When being middleman. How do you handle this work?
    b. How is IMO functional knowledge compared to NMO?
    c. How has your confidence /trust in IMO staff been?
    d. Do you think IMO people are shyer and hesitate to communicate with you?
    e. Do you feel confident in using English orally and written?
    f. Do you write code comments or docs in Norwegian?
    g. How is it to get the customer to write/talk English?
    h. What do you feel about having IMO do more higher level work?

A.3 Confirmation Sheet

Contact information
Name: Mugunthan Dharmadas
email: dharmada@stud.ntnu.no
Mobile: +47 99616346

Supervisors at Mitos Norway

- xxxxx (Director of Innovation)
- xxxxx (Manager)

Briefly about me
I am doing my master thesis in computer engineering at NTNU – Norwegian University of Science and Technology. (Xxxxx). Last semester I wrote a report on challenges and industry solutions in global software development (GSD) with focus on knowledge management.

Briefly about the thesis
The delivery to Mitos focus on *Why Mitos Norway fail to win some contracts when the proposal includes offshoring?* I will also try to find out what kind of obstacles teams in Norway and India meet when they work in a given offshoring project. So the report I will deliver to my university will be trying to answer *What kind of challenges is met by globally distributed software teams who has to communicate and cooperate over distance, and how do they solve these challenges, with focus on knowledge transfer and knowledge management.*

Assurances for the interviewees
The report I write will be totally anonymously because that was a request from Mitos Norway. So the report will neither show that the company in focus is Xxxxx, or the name of any projects or people. You will also get a transcription on your interview that you may approve before I use it. The interviews that are taped will be permanently deleted after the thesis is written, and no one else than myself will be listening to those.

Appendix B Transcripts

B.1 Transcript Ano1

Date: 04. April 2008, written 06.04.2008 **Place**: Bangalore
Duration: 30 min
Interviewer: Mugunthan Dharmadas (MD) **Support:** Mitos Supervisor
Interviewee: Ano1, transcript approved by interviewee

MD: Could you tell me about your role? What you do?
Ano1 says he joined Mitos 3 years ago. He handled some engagements for US clients before starting to work on NCom projects on July 2007. His role is program manager for the Desert project, and therefore he is also the point of contact for the Norway - India communication about Desert.

Ano1 also says that they have leads for each subproject. His main responsibility is to work with his Norwegian counterpart and these project leads at IMO to handle people management, looking at risk issues, and make sure that they have a good quality delivery to the customer.

MD: Are you the only one talking to Norway, or are there other people doing the same?
Ano1 tells that the leads are talking to their respective leads in Norway, but he is on the higher level and keeps talking to the leads too. Also, those below the project leads are also free to talk to NMO staff if they have any issues.

The rest of the interview is more specifically about ProjO:

MD: Can you tell me about how that project is organized? Like, how many in Norway, how many here? What types of roles are in Norway and what types here?
Ano1 says that they have technical and managerial resources in both sites. It is more management, high-level design, and functional design in Norway. India has 20 resources working in ProjO. My Mitos supervisor says that in Norway the amount is 50.

MD: How is the complexity of the project?
Ano1 says it is very complex. ProjO depends on 40 legacy systems.

MD: Do you have direct contact with the customer, or only Mitos Norway?
Ano1 says that IMO talks only to Mitos Norway, and NMO will handle the talk with the customer.

MD: Could you tell me about the demography of the people here? Junior/seniors? Experts? And how you organize it
Ano1 says they follow the standard mix of juniors and seniors that is common in IMO. It is almost 6-8 junior resources (fresh students), 5-6 above, 4-5 above, almost 4, and one in the top.

MD: Could you tell me about the communication with Norway? How does it happen? Tlf, mail, visits etc.?
Ano1 tells that they use all types of communications. They also visit Norway regularly, and NMO staff visits IMO. Sometimes videoconferencing equipment is used. All kinds of communicational methods like telephone, mail, chat etc. is used. MSN Messenger works well in communicating with NMO.

He further tells that video conferencing is a very good way in combination with visits.

MD: Do you think you should have been more in Norway, or the Norwegians should have been more here to get to know the project even better?
Ano1 says that people should visit each other. This is a good way of getting more knowledge about each other, and it helps knowledge transfer. By visiting each other it is easy to know how the other teams work. In ProjO there is a great focus on this, and they try to send and receive people to build more knowledge about each other's work, way of working and the different issues that is raised in different locations. After last November, IMO had two people in Norway, after that one person from NMO came to IMO, and now there is also one NMO resource present in IMO. Also, there is plan for more visits to each other's offices for the future.

MD: Have you been developing any personal contacts during your time with the NCom projects?
Ano1 says that he has personal contact with all the leads in NMO, but not much with customer. With NMO he has several one to one meetings, and also there is interaction on a monthly basis. When asked for how the interaction is with the customer, he says that NCom uses Norwegian instead of English, and that makes customer interaction not possible.

MD: The knowledge transfer, of for instance functional knowledge, knowledge about NCom etc… How has the transfer of these issues from NMO to IMO happened?
Ano1 says that initially IMO lacked much functional knowledge, but they have decreased the knowledge gap by visiting to get more understanding. Within different projects, if there are for instance any change requests that need to be implemented, IMO resources contact SMEs onsite to try to understand the purpose and implication of the change request. He tells that these activities to decrease the knowledge gap are important to efficient cooperation and that this is a focus area for the future.

MD: Have you been to Norway, and met the customer?
Ano1 says he has been in Norway once. But he did not meet NCom directly. Very few people from IMO meet the customer directly, but some of us meet. Especially people from ProjD have met the customer many times. So this depends on the projects. In ProjD, IMO interacts directly with the customer, because there are very few NMO people in that project.

MD: How is the distribution of the work in different phases among NMO and IMO people?
Ano1 says that coding, detailed design and unit tests is mainly done in IMO, while the higher level design, requirements specification and acceptance test is done in NMO. But also this depends on each project, for instance in ProjD almost 100% of the work, including all phases, is done by IMO.

NMO is close to the customer, so it is easier for them to do the initial, customer-dependent work.

The documents are basically written in English, but sometimes the documents from the customer are in Norwegian and then we use NMO to help translating. We use SharePoint for sharing the documents in a very well organized way. People have access to the documents they need depending on their role and project. For instance if he is not working with ProjD, he will not have access to ProjD documents.

MD: Do you use any agile methodologies here?
Ano1 says that they do not use any agile methodologies directly.

MD: Compared to what you believe is a perfect way of communicating with each other, what do you think lacks in the IMO-NMO communication now?
Ano1 says more communication between the leads and team members is the perfect way of communication. Understanding of why we do certain things in certain way sometime lacks between NMO-IMO.

In India people will not raise issues unless they know each other very well. It is Indian culture.

Mitos Supervisor: You have been working with Norwegians and Americans… How do you feel with working with Norwegians?
Ano1 says that when talking about Norwegian Mitos employees, there is not a major language issue. English works fine both with Norwegians and Americans. But when it comes to confidence there is a difference. It is harder to build confidence among Norwegians, and European clients. Americans need less time to build confidence in Indian workers. Until Europeans get the correct confidence level needed to deal with Indian resources, they tend to get into each small detail, and IMO may feel that they are micromanaged.

Mitos Supervisor: How do you feel about NMO's information sharing with IMO? Do you feel they want to share information or that they sometimes hide information?
Ano1 says that there have been some problems regarding lack of information flow from NMO to IMO before, but that it has improved much over time. Also, if there is much risk involved with one delivery, the importance of sharing information and building confidence is stressed even more so that people understand the need to consider them selves as one big team even though they are spread over distance. He also explains that the confidence level is low only in the initial phases, in a few months. Generally it improves over time. Over all he believes that the communication processes is good and that proper communication is happening between NMO and IMO.

B.2 Transcript Ano2

Date: 04. April 2008, written: 04.04.08 **Place**: Bangalore
Duration: 2 hours
Interviewer: Mugunthan Dharmadas (MD), transcript based on memory and notes
Interviewee: Ano2, transcript approved by interviewee

I asked few questions on this interview because the interviewee talked freely when I introduced the topic. Often I only gave a word such as "trust" and asked the interviewee to talk around it based on experience from offshoring.

MD: Could you tell me about your role? What you do?
Answer: Has been working in different sectors such as manufacturing (4 years) and IT (9 years). Has been working for Mitos the last 5 years, being one

of the longest stays in one company. The last 2,5 years he has been working with NCom projects. From before he has been working with offshoring in Dell, GE and Motorola. Now, he is the lead for ProjS project (mainly Application maintenance), which is one of the systems developed to NCom under the Desert-umbrella. He is also one of the leads in handling the whole Desert project-portfolio.

Ano2: He gave a short description of the Desert project/portfolio:

- Approximately 3 years old now, and will continue until 2011.
- Includes several subsystems such as:
    - ProjO
    - ProjS (Finance)
    - ProjD

- All these systems use often same legacy systems (ca. 40), during initial days there was limited knowledge exchange between the difference groups that work with the different systems that Desert consists of. Now this is in much better shape and we are in the process of creating a knowledge base.

MD: Have you been to Norway, if so, when?
Ano2: "for about 2,5 years ago in relation with Desert project start."

MD: So it was a kick-off meeting?

- Ano2: He follows up my question by explaining what happened in this kick-off meeting. He was in Norway for 3 months for the purpose of learning thru knowledge transfer from NMO to him. Initially the knowledge transfer sessions were not as expected.
- Later on, one NMO resource came to IMO for a short KT session. The content of this session was OK.

Ano2 suggests that a kick-off session should have a Proper KT Plan and expectations clearly stated. Post knowledge transfer, there should be plan to assess the resources involved in KT.

Ano2 talks about Documentation after question about what he thinks about its quality and importance:

- Code comments are often in Norwegian. Due to Language Difference difficult to understand.

Confidence and trust:

- As in any work that gets transferred, it takes time to build the confidence and trust.

MD: How did the trust develop over time?

Ano2:

- Time is an answer itself.
- Consistent good Derivable and intent to work closely

Value chain:

- IMO wants to move up the value chain, but it is hard when for instance customer speaks only Norwegian.
- IMO started to gradually starting to certain degree where possible.

Norway should work on:

- More travel between each other to build to understand the domain knowledge and will also help to build relationship with the NMO team members.

B.3 Transcript Ano3

Date: 04. April 2008, written: 06.04.08 **Place**: Bangalore
Duration: 30 min
Interviewer: Mugunthan Dharmadas (MD), transcript based on memory and notes
Interviewee: Ano3, transcript approved by interviewee

MD: Please tell about which project you work under, and what your role is.
Ano3 tells that he started working with ProjD project jan 2007. His role is team lead for the ProjD team in IMO. There has been arranged a trip to Norway which he participated in, and stayed in Norway for 2,5 months. The stay in Norway was the kick-off meeting for ProjD where the focus was on knowledge transfer from NMO to IMO people. IMO also follows NMO's process in addition to follow the IMO's processes. He joined Mitos in December 2006, and his total experience with offshoring (from both Mitos and former employers) is eight years.

MD: How do you feel about the KT-session you attended in Norway?
Ano3 told that it was a very good experience. They learned a lot during the knowledge transfer sessions and it was useful, but should have been longer. It was well organized and offered much information. Of the 8 IMO resources in this project 4 went to Norway for kick-off session, while 4 did not. The 4 who went to Norway was more confident talking with Norwegians than the other 4. The 4 understands the culture of NCom

MD: Can you tell more about the project?

Ano3 explains that the project has 8 people working in IMO and only two in NMO, those two being project manager and one SME. The project itself is a maintenance work with some partial development work. The way this project is organized is experimental within Mitos because there is a very high percentage of offshoring resources compared to other projects. Mitos wants to try out and see how such a mix of offshore and onshore resources will work out. The project is very complex as it depends on other systems that Mitos works on within Desert, and also on legacy systems.

MD: How do you handle contact between IMO and NMO or customer?
Ano3 explains that IMO team have direct contact with client in Norway. He says this has especially three benefits: 1. Easy to get a clear expectation of what the customer need. 2. Few misunderstandings because IMO may ask clear-up questions right away. 3. No delay, because there is no middleman (NMO). The communication towards client is mostly on written English because the client does not feel comfortable in oral English. This works well because similarly some, but not all, IMO resources prefer written communication rather than oral due to shyness or having a reserved personality. On the other hand oral communication is wanted some times because it is faster and you can clear up misunderstandings right away. IMO have been contacting SME in NMO on ad hoc basis before and it has been working ok, but next week they will begin to have regularly meetings each 15th day so that status can be exchanged regularly and problems addressed early.

Ano3 also tells that chat via MSN with NMO is used, but no video conference because there has not been any need to do that.

MD: How is communication among the different teams working on different projects under Desert?
Ano3 tells that because there is interaction between the different systems within Desert, there is also a need for communication among the different teams working on different systems. Thus, Desert is viewed on as one great project in which there exist other smaller projects. He says that people working on different projects within Desert talks to each other about technical issues. 1-2 of the IMO resources working with ProjD, are sometimes transferred to another project because it is a good way to utilize the resources fully.

MD: Can you tell about the documentation work?
Ano3 tells that Sharepoint is used to distribute documents, and it has been used for only a year now. As of April 2007 documents were often in Norwegian, and needed to be translated.

MD: What do you think when I say the word micromanagement, if you are to think of your project?
Ano3 tells that there is no micromanagement from NMO. He do the work distribution and estimation in IMO. He thinks it works fine.

MD: What is your impression about NMO's trust and confidence in IMO?
Ano3 says that he have not experienced any trust or confidence issues from NMO. Also in the beginning there was no trust issues, the project has been successful from the beginning.

MD: Any other points?
Ano3 tells that he think it is important to develop more SMEs in IMO so that IMO can work more independently from NMO.

B.4 Transcript Ano4 and Ano5

Date: 08. April 2008, written: 08.04.08 **Place**: Bangalore
Duration: 30 min
Interviewer: Mugunthan Dharmadas (MD), transcript based on memory and notes
Interviewee A: Ano4, transcript approved by interviewee
Interviewee B: Ano5, transcript approved by interviewee

Both interviewees work on the same project, but in different fields within the project. They were both interviewed simultaneously and the questions were mainly directed towards both.

MD: Can both of you please tell about the project you work in and what your roles are?
Both: Work with Oracle ERP system within the ProjS project. The system is for financial use with billing, purchase etc., and is one of the projects under the Desert-umbrella. There are totally 9 IMO resources, and about 4-5 in NMO AM(Application Maintenance) and about 3-4 in NMO AD(Application Development). The projects have been ongoing several years before IMO was involved, and now it is mainly a maintenance project. NMO worked with ProjS for some years before IMO was involved. Now also there is no team lead for the project, so they talk directly to project manager at IMO who will handle all the managerial communication with NMO, while for some technical questions IMO-resources, as themselves, contact NMO directly.

Ano4 said her role was in maintenance (AM) and support while Ano5 said her role was within development (AD) and functional understanding.

MD: Have any one of you been to Norway, if so, what was the purpose, and what do you feel about the trip?
Ano5 said she and another person went to Norway in the beginning of an analysis project within ProjS. The purpose of the trip was to interact with the customer, but the trip did not help that much because they rarely met the customer face to face. Most of the communication was still handled through emails with the customer.

Ano4 said she went to Norway because of a big change order from the customer. This happened two years after project initiation.

MD to Ano4: What do you think about visiting Norway two years after start? How do you think your understanding of the system would have been if you went there earlier?
Ano4 told that the trip helped to understand the problem better, but there were other IMO resources that had been to NMO before her, so they helped in giving her information about the project. She does the same now to the juniors under her, and this has worked well she thinks.

MD: To both, can you describe the communication and knowledge transfer between IMO and NMO?
Ano4 explained that the communication was like: Customer ←→ NMO ←→IMO, so IMO rarely had direct contact with customer. But she thinks IMO should be talking much more to the customer because, as she said: "Requirements does not reach to IMO properly", stating that because of the two-step communication, there is a tendency of mismatch of the original requirement from customer and the one IMO gets. If IMO could have been involved earlier this two-step communication would be reduced to first-handed information. Sometimes videoconference is used to hold presentations, especially when SMEs want to leave NMO, because then the knowledge needs to be fully transferred to others.

Ano5 explains that the communication has three nodes, as Ano4 told. She believes that this communication works as long as the requirements are simple, but when they are complex this way of communicating is very problematic, because it is hard for her to understand the requirement and the context around it when she is not communicating directly with the customer. Further, she tells that they also have a weekly meeting with NMO for communicating status. This is very useful.

Both say that mails are also used as a way of documenting what NMO or customer ask for or what they explain. They also explain that they talk to NMO people on only technical issues, other issues, such as managerial is handled through the IMO project manager who then talks with his Norwegian counterpart. Also a quarterly feedback meeting is arranged, where both IMO and NMO can give feedback on each other on what they do good, and what they should improve. This is a good practice, especially because IMO can also give their feedback on what they feel about NMO.

MD: To both, what do you feel about this way of communicating through NMO?
Ano4 says that NMO likes to control the communication and be the gateway between IMO and customer. She thinks this is good and works well in the initial phase, because IMO lacks a lot of functional knowledge and has no overview of the system. But now the project is over two years old, and IMO has a good understanding of both the big picture and the details, so they should get the possibility to talk directly to customer.

Ano5 says clearly "We won't be able to solve the problem even though we can because we don't understand some of the new requirements or problems due to inefficient communication." She believes communication with NMO is good when it comes to managerial issues and they are good in English, but it is when they are the middleman in technical, requirements or functional communication the problems occur.

Several times, both Ano4 and Ano5, explains how the Norwegian customer dislike using the English language, especially orally. They give examples of meetings held in Norway between NMO and customer, which IMO resources took part in through teleconference. The customer did not want to switch to English after request from both IMO and NMO resources. Even though NMO tried to get customer to use English, so IMO can understand what is happening, the customer refused because of lack of comfort in using English. Ano5 tells that she thinks some customers prefer not to talk to IMO directly because of 1. They dislike using English, 2. They may feel that IMO is not equal as NMO, in the sense that IMO are second to NMO in for instance knowledge.

They both also complain about many documents that come to them in Norwegian. This is true both for documents made by NMO (i.e. requirements doc) and documents by customer (i.e. technical specifications). This has been ongoing from the start, and is happening even today. They explain they sometimes use the automatic Internet translation service TriTrans, along with other similar services, to translate the Norwegian documents. The translated

document can be used, but it is not very good. Now, they have started using external translation companies to do some of this work for them.

MD: To both, think of myself as an NMO SME that you have never met or talked to. How would you feel about contacting me for questions?
Both agree on that they will not hesitate to send an email. They will explain the project and the question according to a template and give me links to relevant information so I can answer. But they both would not have wanted to call on the phone at all because they feel uncomfortable with talking to me without have met me or seen me on a videoconference in advance. They feel that after personal meeting or through videoconference, they will not hesitate that much to pick up the phone and call me.

Both also say that IMO team should be included in initial phases of the work, and they explain that this may be hard to accomplish because:

- The customer prefers using Norwegian, and that is hard for NMO to do anything with.
- NMO do a good job translating, and trying to convince the customer of using English, but that is only a step on the way.
- Often the documents are in Norwegian, so 3rd part freely available translating tools in Internet need to be used, such as TriTrans. Which does not necessarily give the correct translation.
- NMO prefers offshoring low-level work to IMO.
- Now, IMO have very poor understandings of the overall picture and the requirements due to lack of participation in the early phases.

MD: How do you feel about NMO's trust and confidence in your work?
Ano4 said that this was a problem early in the project, where NMO did not fully think they were capable of doing this work, but this confidence has increased over time, and it is good now.

Ano5 said that AD-team in NMO was confident on IMO from early start.

MD: What do you feel about NMO's eagerness to offshore projects to IMO?
Both say that they have never experienced that NMO did not want to offshore, so they are confident that NMO wants to work with IMO. Ano4 also tells that NMO really tries to help in all way when IMO needs help, even if it is not office time in Norway.

B.5 Transcript Ano6

Date: 08. April 2008, written: 09.04.08 **Place**: Bangalore

Duration: 30 min
Interviewer: Mugunthan Dharmadas (MD), transcript based on memory and notes
Interviewee: Ano6, transcript approved by interviewee

MD: Can you please tell a little about your background and role in the project, and a little about the project?
Ano6 tells that she has been working with IT from 2001, she joined Mitos in 2003, and has been working with ProjO from the time it was offshored in 2004. ProjO is mainly a maintenance project, but some new development is done if customer has any change request. She tells that there are 19 IMO-resources and seven of them went to Norway to get knowledge transfer. She, herself, has never been to Norway. Her role is team lead, but she has only a very soft managerial role over those she is team lead for. Her mainly team lead duty is to distribute the work among the people she is lead for. She said they do AD and AM work at IMO. She is mainly into AD where they will be delivering the change request approved by customer. Her responsibility will be to make sure that they deliver the quality work within the mentioned deadlines into production. They do this as a release to production for every 3 months. They ensure quality by doing design reviews, code reviews, test scenarios review etc. and document the same for future use and constant development in their deliverables.

ProjO is very complex with over 40 modules, and the documentation is poor or insufficient. She gives an example of problems that occur because the system's GUI should be in Norwegian: "All screenshots we get is in Norwegian because it shall be in Norwegian in the final product, but we do not understand much of it. We need translation to be able to understand what the different GUI elements means. We use tools such as TriTrans to translate, and this is hard, because some times we misunderstand due to insufficient quality in the translation and lacking functional knowledge."

MD: How is the communication between IMO, NMO and customer?
Ano6 tells that if there is any defects, the customer report it in Norwegian by logging it into a system, called ITG, which holds all the reported defects. NMO checks ITG and contacts the customer if they do not understand the explanation of the defect. After some communication back and forth between NMO and customer, NMO gets a good view of the problem, they find a solution to the problem, and asks IMO to implement and test the solution. After we have written the code and tested the solution, we report it in the ITG so that the solution for the defect is documented. There are two challenges with working like this:

1. The information we get of the defect is a short version from NMO where they explain the problem as they have understood it after some mail correspondence with customer, or else they would translate one of the last mails from customer where they feel the defect is explained thoroughly. While NMO sends several mails and clear-up questions for getting to know the problem well, we are supposed to understand it by one of the last mails or a short description by NMO. This gives us not as good view of the defect as we would have got if we were able to read through the full mail correspondence. I think we should get more info than what we get now, so that we may have a better understanding of the problem.
2. The defect is solved by NMO, we only code and test it for them. "I don't say we would design better solutions, but may be sometimes we could have made better solutions, if we were involved in the problem resolving activity By only coding a solution made by NMO, we won't get more business understandings or better functional understanding of the solution."

Ano6 also tells that "When IMO gets a change request, we think *what shall be changed,* we do not think *why shall this be changed?*" Thus, they do not learn much new, or they do not get more business knowledge, which they should get to minimise the business knowledge gap between NMO and IMO. Also IMO does very little knowledge intensive or creative work nowadays because NMO's SMEs design solution for errors and change requests. IMO just code and test the solution designed by NMO.

MD: You say that NMO handles most contact with customer, how do you feel about it, and would you prefer continuing this way or would you have more contact with the customer?
Ano6 says that NMO does a good job when communicating with customer, and by being shielded from the customer it is less stress at IMO. So this way it is nice to not have direct contact with the customer. But the main problematic issue with this way of communicating is that we don't learn much. We do the same type of coding again and again, without learning much about the domain. "I am in an imaginary world, where I have not met the people I create system for, and I don't even have a very good understanding of the domain of functions I am creating." "Everybody know what everybody know here at IMO" She thinks that IMO is stuck with a way of working that does not increase their knowledge over time.

MD: If I was an SME at NMO that you have never met before or never contacted before, how would you contact me if you needed to ask me something?

Ano6 says that she would prefer mail first, and then asking for a meeting over phone. She likes to send mail first, but she does not hesitate to make a call as the first contact. Some of the other people she work with would have hesitated to make a call she said, after I asked what she thinks others she work with would prefer.

Somewhere in between some questions she says that Norwegian clients are quite ok to work with compared to US-clients. And I ask why. US clients are very strict about deadlines, and give short deadlines. Also they are much harder to convince, than Norwegians. That is at least her experience from a former offshoring project for a US client that was also a maintenance work.

MD: Going back to how you communicate and knowledge transfer… Can you give some examples of how you do that?
Ano6 says that NMO often sends many docs with basic information. Some times conference calls are used to deal with more complicated issues that need to be discussed. Often when it is pure knowledge transfer from NMO to IMO by an SME in Norway, NetMeeting is used so that the SME may also conduct a visual presentation. Usually they record the whole conference, so that everything that the SME tells or shows will be recorded for later use, so they do not need to bother the SME unnecessarily with the same issues. These recordings are very useful when they get new staff joining the project in IMO because now they do not need to explain everything to the new project member, but he can watch and listen to the recordings himself.

Ano6 also gives another example of how communication is hard due to dependencies on someone on the other side of the world. ProjO runs over some data that are configured in Norway and the data is also stored there. If there are some configurational issues with the data in Norway, IMO cannot continue doing their work easily. Then they need assistance from NMO, but due to different time zones it may not be office time at NMO when IMO encounters their problem. But generally when such problems occur, NMO is fast and good at solving the problem. The Norwegian offshoring contact for ProjO is accessible at any time, and she contacts the right people at NMO to fix the problem as fast as possible.

MD: What type of jobs or what phases do you work on at IMO compared to NMO?
Ano6 says that IMO do mainly coding and testing, while NMO do the levels above, such as requirements analysis, designing solutions etc., but they have started to do designing for some change requests.

MD: How do you characterise your functional knowledge about the system?

Ano6 says that she have quite good view of the system now, but a trip to Norway, meeting the customer would have helped much in developing a good functional and holistic view of the system earlier. She also believes that meeting customer and see how they work and how they use the system would have given her a more meaningful job in the sense that she would know how her own work contribute to the customer's world.

MD: How do IMO and NMO communicate what you like and dislike with each other?
Ano6 tells that they have quarterly feedback meetings where both sides may criticise the other part or tell what the other part does well. For instance we often hear that our work is not good enough, that the code quality is not good enough.

MD: Do you have anything else you want to say in relation to knowledge transfer or communication between NMO and IMO?
Ano6 says, after thinking for a while, that there is an issue at IMO that technical resources who have been working for some years at IMO becomes managers or get other type of managerial roles such as team lead, project lead etc. This is the Indian career ladder she says, so it is not awkward, but she thinks IMO should open up for a pure technical career ladder. Technical staffs that want to continue with technical work year after year should do that and get the promotions within his technical role. The salary should of course also mirror similar managerial roles and depend on seniority. The system should be similar to those in other Mitos offices in other countries.

B.6 Transcript Ano7

Date: 08. April 2008, written: 10.04.08 **Place**: Bangalore
Duration: 15-20 min
Interviewer: Mugunthan Dharmadas (MD), transcript based on memory and notes
Interviewee: Ano7, transcript approved by interviewee

This interview was conducted in a hurry because MD had to travel to another city, so the time was short, and MD was a little stressed. Also, the interview with Ano7 was not planned in advance. It was a sudden possibility, which MD wanted to use to acquire more info. The length of the interview was shorter than the other interviews because MD had to leave. These reasons caused the interview to not be conducted in a sufficiently proper manner in the sense that MD was not able to dig deep with follow-up questions.

MD: Can you please tell a little about your background and role in the project, and a little about the project?
Ano7 tells that he is a senior software developer in ProjO. ProjO has ca 20 IMO resources, which includes 1 project manager and 3 team leads. He has been working with ProjO the last 2,5 years, and a total of 3 years in Mitos. Prior to employment in Mitos, he has no offshoring experience.

MD had been interviewing people from ProjO, so MD soon focused on the knowledge transfer issues.

MD: How would you characterise the communication between IMO and NMO?
Ano7 thinks that mainly, approximately in 90% of cases, the communication works well. He has experienced problems only a few times because the information to transfer from NMO to IMO was complex. Also when documents are in Norwegian, there is a need to translate, and this may cause misunderstandings. He tells that they use several free Internet services for translating from Norwegian to English, but he did not remember the name of the services.

MD: In what way would a trip to Norway influence you or impact your way of working?
Ano7 says he has never been to Norway, but a visit to Norway is a good way of learning much. He may talk directly to the customer and by that acquire more functional knowledge. Also, by travelling to Norway, he may meet his NMO colleagues in person and develop good relationships with them.

MD: If I was an SME at NMO that you have never met before or never contacted before, how would you contact me if you needed to ask me something?
Ano7 says that email would have been the first way of contacting me. But later on, after a few email correspondences, he would use telephone meetings when important issues need to be discussed. He believes that such telephone meeting is a good way of communicating.

MD: How would you compare your functional knowledge and NMO's functional knowledge?
Ano7 clearly states that "1,5 years in NMO is comparable to 2-3 years in IMO" because of the smaller amount of exposure to functional info at IMO. NMO's direct and frequent contact with the customer, and their capability to talk Norwegian, makes it possible for them to acquire more functional knowledge in a shorter time.

MD: If I say the words trust and confidence, how would you relate that to the NMO - IMO relationship?
Ano7 explains that NMO has developed their confidence and trust in IMO over time. Initially the confidence was somewhat lower than wanted, but it has increased very much over time. He says, "In a way we have to prove for them". Now, the confidence and trust NMO has for IMO's work is good.

MD: Do you do any socializing activities with NMO people when they visit IMO, and conversely when IMO resources visit NMO?
Ano7 said that such activities happened, for instance going out together for having a dinner.

B.7 Transcript Ano8

Date: 23. April 2008, written: 25.04.08 **Place**: Oslo **Duration:** 35 min
Interviewer: Mugunthan Dharmadas (MD), transcript based on voice recordings
Interviewee: Ano8, transcript approved by interviewee

This is not a verbatim transcription, with the exact words of the interviewee, but it is a summarized version. There are some quotes from the interviewee though, and they are clearly marked with quotation signs.

Before starting the interview I was informed about the uncertainty of the length of the interview, because if there were any phone calls from the customer, the interviewee had to go. With this as basis, I focused more on trying to triangulate the results from the interviews in India.

MD: Can you tell a little about the project you work in? What kind of organizational model, what type of project etc.?
Ano8 explains that ProjO has approximately 52-53 resources if you add the NMO and IMO staff, but the total amount of people varies depending on the need, but generally it has been increasing, especially offshore. The distribution between the two sites is around 30-35 in NMO and around 20 in IMO. It is mainly a maintenance project, but the change requests they implement may be of a size that is comparable to development projects. The project is organized with two teams, one AD (Application Development) and one AM (Application maintenance) team. AD teams are the largest, both in NMO and IMO.

MD: Can you tell about your role?
Ano8 tells that she works with ProjO as the overall offshoring responsible for both AD and AM, and she is also the leader of the AD team in ProjO. In AD

team, she has the responsibility from estimating to delivery. The coordination in terms of planning, issue handling and delivery are areas where the communication between IMO and NMO goes through her, but for other issues such as technical questions or similar, IMO and NMO resources take contact with each other directly. She is of Indian origin but lives in Oslo, and has been working in Norway for many years.

MD: When did you start in ProjO, and how many times have you travelled to India in relation with ProjO? What was the purpose of these visits?
Ano8 tells that she started in ProjO in 2005, and has been working with it since. In the three years she has been working with ProjO, she went to India three times.

The first time she went was for a knowledge transfer session in relation with the start-up of offshoring of ProjO. Among other things, she wanted to take part in the process of choosing the right resources to the ProjO team in IMO. Ano8 continues explaining that offshoring of ProjO started prior to her involvement in ProjO with another offshoring responsible, but it did not go that well. The reason was the ProjO was in product testing phase that time and offshoring was not high priority.Some of the IMO resources did not suit their role or they expected something different than what was possible to get through ProjO, so they were changed so that other IMO resources took their roles. Some other challenges was also dealt with: There were problems with the knowledge transfer from Norway to India because it was little focus on this transfer of knowledge, and nobody in NMO had time to take part in the knowledge transfer process due to high focus on delivery to the customer. The IMO resources were supposed to read documents and get the required knowledge through this reading. Most of the documents were in Norwegian, so this was another great challenge. Also, there were some expectation mismatches that were problematic. In addition there were also some planning issues. In addition, the person responsible for offshoring was leaving Mitos at the time. All these factors caused lack of motivation at both NMO and IMO. In sum, the offshoring was not started in a proper way, so there was a need for change.

MD: Can you try to explain the differences between Indians and Norwegians from your experience with working with both? Are there any cultural differences that cause different and conflicting behaviour when working together?
Ano8 explains that she do not believe it is the cultural differences that are the main difference. The personal differences among people are more important to consider, because you will also find shy Norwegians who prefer emails to

phone calls. She believes that Indians may be shyer than Norwegians, but tells that still you have to consider the individuals, not the group as a whole.

Ano8: "If I have not met a person, I do not know if I ask this question or if I react like that, what will be the reaction of the other person." And that is one thing, which can happen both Indian-to-Indian, and Norwegian-to-Norwegian. But it adds up more uncertainty in case you are from different background, and you do not know what level they are in."

Ano8: "If I have to call somebody in US, and I know he is a partner or something, I might have some restrictions (…). If I say something in a certain way he might not like it. If I met this guy, and I know how he reacts, what he likes or not likes, there will be no hitch next time if I have to ask him anything."

Ano8: "If an Indian asks me in India, *So, how is the weather? Is it sunny?,* I will start laughing and think what kind of questions is that. We are used to having sunlight the whole time, so we do not ask similar questions. But, this question might be very important in European, or US terminology." She explains that this may be a type of cultural difference, or an example that illustrates that people talk about what is unusual or lacking in their world, and in such cases people from different cultures tend to focus on different things.

Ano8 continues telling that it is more flat structure in Norway, while India has some more hierarchy in the organization. Even though there is a change towards more flat structure in India nowadays, the hierarchy may cause an Indian to be more reluctant to talk freely with someone in a higher level in the hierarchy. Similarly Norwegians way of talking to their superior may be less suitable when communicating with an Indian superior.

Ano8 also tells that the physical distance has other impact on the information flow. Developers, regardless of cultural background, tend to not prioritize informing about their status and progress, which may for instance cause that they struggle with an issue that may have easily been solved if they were discussed with others. They may think that they can inform the others after finishing their work, but this cause the others to not know the status of the module this developer is working on. When co-located this challenge may be solved by just informally talking with the developers, but when there is physical distance, these issues may have greater impact on the progress or confidence among the team members. This is another example for focusing more about the individual differences among people rather than the cultural. She also notes that most of the people you are interacting with in India are developers, not managers, thus amplifying the effect of the issue that

developers do not find giving status information as important as mangers do. They see the same problem onsite also but it is not an issue at onsite because they sit in the same place and discuss during lunch.

Ano8: "Sitting on the other side of the globe (ed. in Norway), you think nobody is working on the defect (ed. in India), but that is not true. It is just that this guy (ed. developer) did not feel like informing about this. But if the same guy is sitting next to me, I will go in the morning and ask him. And he will tell me, so confidence and trust develops with this co-located guy. But when he is not sitting next to you, and that person do not feel the importance of communicating to you, then you feel that things are not working. I think the importance of the flow of information and communication is something you have to explain to the developers, both onsite and offshore."

MD: What kind of activities do you do to try to promote better understanding of each other's way of being? What kind of other knowledge transfer activities do you do, other than visiting each other?
Ano8 says that they have some cross-cultural programs in the organization, she has taken the course but she feel there are not too many cultural difference when it comes to working in office. Ano8 also tells that for handling different people from different cultures, it is not only the cultural understanding which is important. Also your management capabilities and people knowledge is important. She says that gut feeling about different people helps you to know how to approach different people irrespective of culture.

She is situated in Oslo, but has to communicate with staff in Bergen, Lillehammer and India, and they are similar in the way that there are geographic distances which cause face-to-face meeting less possible. Also, the distance may cause thinking of each site as different unities and using the words *them* and *we*. These types of problems do not occur because of the different cultures but because of the physical distance, although it may be amplified by the cultural differences.

Ano8: "More than cultural differences, it is the distance that make people uncomfortable."

Ano8: "When it comes to shyness… I have lot of resources here (ed. in NMO) who comes and talk to me (…) after every 10 minutes, and I have some few resources who do not even talk, but only sends mail, even though they are sitting next to you."

Ano8 says She has helped Norwegians to conduct interviews towards Indians during the hiring process in IMO. This way she gave them knowledge about how to interact or lay expectations with IMO.

MD: How do you accomplish knowledge transfer from NMO to IMO in other ways than by visiting?
Ano8 tells that they for instance use *New Joiners Kit,* which is a set of documents with overview information, videos from presentations held by SMEs, screenshots and voice recordings from NetMeeting etc. This kit is used both in NMO and IMO when the project teams get new staff members. In this way they can ensure that the new joiners get a quick introduction to the project at the same time as getting deeper knowledge through the SME-presentations, without too much effort from the existing team members. Often the size of the teams changes and increases over time, and by using the New Joiners Kit they are prepared to handle these changes in a structured way. Creating the New Joiners Kit ensures that there is a focus on knowledge transfer from early in the life of the project. The practice of New Joiners Kit has also been transferred to other projects because it was successful.

Ano8 also says that she tries to encourage people to use phone instead of emails because it is faster to communicate verbally, and also it is also easier to respond and correct misconceptions during a telephone conversation than through emails.

Minutes of meeting are often used so that your understanding from a telephone conversation may be tested and approved so misunderstandings can be avoided. For instance it is useful that an IMO resource writes a minute of meeting after his conversation with an NMO SME, so that the SME can ensure that IMO has interpreted the conversation as intended. If something goes wrong, it is easy to see if it was the SME who gave wrong information, or if it was IMO who did not follow the process outlined by the SME.

Chat is something she does not encourage, even though she knows that it may be a useful way of communicating. She believes that email is more preferable than chat because it is easier to reuse the email in the sense that it serves as a document describing something someone has told, and it is preserved the way it was written. Accountability is easier when having emails as documentation for what different people has told. Also by, adding your superiors or other involved people as receiver of the emails, you can ensure that other people know what you are doing, and what issues you are facing. These advantages are hard to achieve with chat. Even when coding, they use emails or telephones rather than chat.

Ano8 continues telling that often there can be difficulties for Indians to create GUI elements, which is in Norwegian, because they do not understand what the text on for instance a button means. In the case of NCom, there has been made a custom dictionary containing many domain specific and customer specific words so that it may help the IMO teams to easily understand some frequently used Norwegian words. As a curiosity she tells that some Indians actually use the Norwegian words such as *konto* and *kunde* instead of *account* and *customer* when discussing both internally at IMO and also with NMO members.

MD: Other than the GUI elements, what language do you use on code, code comments and documentation?
Ano8 tells that they use English as the main language for all these texts. Only GUI elements are in Norwegian, because that needs to be in Norwegian. There may be someone who did not pay attention to what management have told the developers about using English. But she has not seen any Norwegian in these texts. Some times also requirements come in English from the customer. but there may be some small change requests that come to NMO in Norwegian.

MD: How do you deal with the ownership feeling?
Ano8 says that ownership feeling is of tremendous importance, so they try to encourage people to feel more ownership for the product they work with. Visiting each other is one way of doing this because if you are in India, not knowing much about the customer, your colleagues in Norway, or not having much domain knowledge, then it is hard to get a real ownership feeling. Also NMO focuses much on stating clearly what is expected of IMO and their work. This way everyone get clear view on what is expected of him or her and what impact their work has on the rest.

Ano8: “It is just ownership. I feel if you have ownership from onsite to do offshoring… Believe me, you will have less hazards and less problems and less issues.”

Ano8 continues telling that she sees a difference after IMO-resources visit Norway and then go back to work in India. They show more motivation and feel more ownership because now they know both NMO resources, and maybe also the customer and the product in real life use. Similarly, when NMO people visit IMO and come back, they get more comfortable with the offshoring situation, and they feel more ownership with the offshoring work.

MD: What do you feel about IMO doing more higher-level work? In other words, what do you think about IMO climbing in the value chain?

Ano8 tells that in ProjO they started with defect fixing, then they did coding for change requests, then they began doing detailed design for the coding. Now they are even doing some analysis work.

Ano8 says that for IMO to climb in the value chain there is a need to consider trust in IMO, and capability, competence and capacity at IMO. If all these factors are satisfied it is not a problem giving more high-level work to India. Already ProjD is an example where IMO do all the needed work. She says that when IMO are comfortable with working on higher level, and has a great ownership feeling, the risks of offshoring the higher-level work will decrease. On the other hand, if a change request from the customer deals with several external factors and is dependent on much customer interaction, NMO is the preferred location to do the higher-level work. For instance if there are no interface specification and interface specification documentation is lacking, there is a great need to sit together with the customer to define and design the interface, and in such circumstances it will be difficult to give the full responsibility to IMO. In other cases, IMO could be a similarly good choice as NMO.

Ano8 continues that depending on the situation they try to involve IMO early so that they develop ownership and the comfort level increases early. Ano8: "If I involve someone the last minute, the ownership will not be there, and then you will not be comfortable anyways."

Ano8 also tells that several NMO people have known NCom people for as long as 15 years, and many of them are like pals. These circumstances may do it easier for NMO to deal with the customer than it is for IMO.

MD: How would you characterize the functional knowledge in IMO and NMO?
Ano8 says that NMO has maybe 20 years of expertise in this domain and with the same customer. This cannot be learned by IMO in a few years. So in business knowledge some of the NMO is in some level superior to IMO, but for instance in coding or GUI-implementation IMO is comparable to NMO, and in some cases IMO is even better.

She tells further that the learning curve is a little longer in IMO due to longer distance to customer and SMEs, in addition to the fact that NMO is more exposed to all customer related issues.

MD: Do you think NMO people are comfortable with using English?
Ano8 says that she has not felt that that has been an issue. Mostly everyone talks and writes English, but there may be a few that do not feel comfortable

with talking English. Mitos is very international, so it is not possible to only use Norwegian. Most internal training and web training are for instance in English.

MD: Are you satisfied with the way you use Sharepoint related to access documents across projects? For instance, within two different Desert subprojects, how can a person working on ProjD access ProjO documents?
Ano8 says that it is not possible. If such need is present, the person need to contact the project lead for ProjO to ask for access, and only if the access is granted, you may access ProjO documents. But such requests have not happened as far as she knows. She explains that there is often not a need to do that, and if there are some technical questions, they ask the ProjD person directly.

Even though both these projects are under the same project portfolio, Desert, it is not possible to access documents across project boundaries. This goes for both NMO and IMO.

Appendix C Analysis Matrixes

Two matrixes were made, one with different properties for the three different projects, the other with different properties for the eight interviewees.

C.1 Matrix: Properties Based on Projects

Description\Project	**ProjS**	**ProjD**	**ProjO**
Nr of members in NMO	4-5 (AM), 3-4 (AD)	2 (PM and SME)	30-35
Nr of resources in IMO	9	8	20
Notes	Ongoing in NMO befre IMO was involved	Experimental project: IMO does almost 100% of work	
Technology		Cobol, DB2	J2EE
Role type mix NMO/IMO	-	NMO: PM and SME, IMO: developers	tech and mgm. In both
Differing phases in NMO and IMO?	IMO mainly on code, test.	IMO does everything	IMO:low level. NMO on rest
IMO devs talks directly with NMO	Yes	Yes	Yes
IMO talks directly with customer	No	Yes, very much.	No
Customer interaction when in Norway	No, not face to face. Only over email.	Yes	No
Project place, doc distribution	SharePoint	Sharepoint, works fine	SharePoint, works fine
Complexity?		high	high, depends on 40 legacy sys
Development or maintenance?	mainly AM, but also dev due to CR	mainly AM some AD	
Issues			
NMO writes docs in Norwegian	*code comment in Norwegian*	*For a year back, some docs in Norwegian.*	No
Customer writes docs in Norwegian	*code comment in Norwegian*	*For a year back, some docs in Norwegian.*	Yes, translated to English by

			NMO
NMO lacked confidence on IMO initially	Initially yes 2/3	No, good trust from start	
IMO lacked confidence on NMO initially	-	No, good trust from start	
NMO's conf. on IMO has increased	Yes	-	
Thinks more visit is necessary	yes	-	
Why more visit?	domain knowledge, build relationships		
Prefer mail before phonecall	Yes 2/3	-	
Identify IMO people as shy	-	Yes some.written over oral.	
Wants more high level work	Yes, up value chain		
Wants more communication with customer	Yes, to move up value chain. Direct comm. removes one step that may cause errors.	Has very much communication already	
Data changes from cust to IMO	Yes, data changes when going through NMO.	NMO as middleman is used rarly.	
Wants to acquire more funtional knowledge	yes, for moving up value chain	Yes, to work more independent from NMO SMEs.	
Feels they are micromanaged	No	No, IMO has much control.	
Feels NMO do not want offshoring	No		
The *Why do we do that?* knowledge at IMO should improve	Yes, often they lack this knowledge.		Yes, both ways.

C.2 Matrix: Properties Based on Interviewees

Description/Interviewee	Ano1	Ano2	Ano3	Ano4	Ano5	Ano6	Ano7
Role:	program manager	TL/ass. Program manager	Team lead	dev/maintenance	dev	TL/dev	senior developer
Nr of years in Mitos	3	5	1,5				3
Nr of years in Desert	ca 9 m	2,5	1,5				2,5
Project	All	ProjS/All	ProjD	ProjS	ProjS	ProjO	ProjO
Former offshoring experience	some with US	Worked with offshoring in several american companies	total of 8 years				No
NOTES	Answers are ProjO spesific						
Nr of visits to Norway	Once	Once, 3 months duration	Once, 2,5 months duration	Once	Once	No, but wants	No, but wants to
Purpose of visits to Norway	-	For 2,5 years ago in relation with Desert project start. Kick-off	Kick-off for projD. 4 out of 8 IMO staff in projD went to Norway.	A large change order from the customer.	Customer interaction in relation with a new analysis project.		-
Visit suited purpose	-	yes, but KT plan and expectations should have been stated better	KT-session very good. Those who visited Norway are more confident talking to NMO, also they understand NCom culture	The visit helped her understand the change order better.	No, rarly met customer face to face. Most communication through emails.		-
Has direct communication with NMO	yes, that is his job	1	Yes, some ad hoc communication with SME in NMO. Works fine.	Yes, on technical issues	Yes, on technical issues	tech	tech
Has direct communication customer	No, customer prefer using Norwegian		Yes, very much. No middleman. Mainly written communication.Some IMO staff prefer written, due to reserved personality.	No, but wants to	No, but only needed when complex issues. No need otherwise.		
Issues							
NMO writes docs in Norwegian		Code comments often in Norwegian. Not sure if written by NMO or customer		Yes, a major hinder. Happens even today.	Yes, a major hinder. Happens even today.		Some docs in Norwegian
Customer writes docs in Norwegian	Yes, and NMO translates	Code comments often in Norwegian. Not sure if written by NMO or customer		Yes, a major hinder. Happens even today.	Yes, a major hinder. Happens even today.		Some docs in Norwegian, do not know if customer or NMO
Customer lacks confidence with IMO	Compared to US customers, it takes more time to build confidence among europeans	Yes, but have improved due to time and good deliveries. Not sure if talking about NMO or customer			Feels sometimes customer may not want to talk to IMO due to language or because IMO is seen as second to NMO.		
NMO lacks confidence on IMO initially	yes, but improves over time	Yes, but have improved due to time and good deliveries. Not sure if talking about NMO or customer		Yes in some degree, initially NMO did not think IMO was capable. But this has increased much, and is good now.	No, confident from early start.		

Description/Interviewee	Ano1	Ano2	Ano3	Ano4	Ano5	Ano6	Ano7
IMO lacks confidence on NMO initially	yes, but improves over time						Initially. improved much over time, and is very good now.
Why more visit?	better understanding of the others, their work and issues they face	build more domain knowledge and relationship with NMO resources					yes,to get funtional knowledge, meet customer, and build good relationship
Prefer some mails before phone first tme	-			yes. Do not hesitate to send email, but uncomfortable with phone as first interaction.	yes. Do not hesitate to send email, but uncomfortable with phone as first interaction.		Prefer email as first interaction. After some interaction, telephone is ok.
Identify IMO people as shy	Indians will not raise issues unless they now each other very well		Yes some of them. Prefer written communication over oral.			some	
Wants more high level work				Yes, they should be involved in the initial phases.	Yes, they should be involved in the initial phases.	Yes, do much of the same things	
Wants more communication with customer	-	Yes, that is the way to og if wanting to move up value chain	Has very much communication already	Yes, initially OK because they lacked functional knowledge and overview. Now, they know much, and should interact with customer.	Yes, NMO good on mng work. technical or functional communication, problems occur. Prefer talking directly.	yes	
Data changes too much from cust to IMO	-		NMO as middleman is used rarly.	YES	0,5		
Wants to acquire more funtional knowledge	-	Yes, and wants to move up value chain	Yes, so that they may work more independent from NMO SMEs.	Yes, IMO has poor overall picture due to less participation in early phases.	Yes, IMO has poor overall picture due to less participation in early phases.		
Feels they are micromanaged	When customer not confident in IMO, they og into each datail, making IMO feel micromanaged		No, IMO has much control.	-	-		-
Feels NMO do not want offshoring				No, NMO shows they want offshoring	No, NMO shows they want offshoring		-

Appendix D Affinity diagram