Success Factors in Building and Maintaining Trust Among Globally Distributed Team Members

Samireh Jalali and Branislav Zlatkovic
This thesis is submitted to the School of Engineering at Blekinge Institute of Technology in partial fulfillment of the requirements for the degree of Master of Science in Software Engineering. The thesis is equivalent to 40 weeks of full time studies.

Contact Information:
Author(s):
Samireh Jalali
Email: samire@gmail.com

Branislav Zlatkovic
E-mail: branislav@pe3.net

University advisor(s):
Cigdem Gencel, Darja Šmite
Department of Systems and Software Engineering

School of Engineering
Blekinge Institute of Technology
Box 520
SE – 372 25 Ronneby
Sweden

Internet : www.bth.se/tek
Phone : +46 457 38 50 00
Fax : + 46 457 271 25
ABSTRACT

Globalization trends have affected many software organizations in the past years. They are turning towards global software development (GSD) market in search for quality with a lower price and shorter development times. It turns out that certain management methods used for in-house development are not applicable in GSD, often resulting in a failed project. It is believed that trust is one of the key factors for success or failure of such projects. In the first part, this thesis studies the causes of lacking or losing trust in globally distributed teams through a literature review and systematic review of current research. The second part of this thesis studies the practices which have been applied in industry to prevent or minimize the impact of trust related issues. Finally these practices are mapped to the identified issues, resulting in a set of recommendations for managers involved in GSD.

Keywords: Trust, Trust Building, Trust Maintenance, Global Software Development.
ACKNOWLEDGEMENTS

First and foremost, we would like to thank our supervisors, Dr Cigdem Gencel and Dr Darja Šmite for their support, guidance and encouragement, useful suggestions and fruitful discussions. We are also grateful for their support in providing industry contacts for our study.

We would also like to thank our interviewees for giving us a part of their precious time, the valuable information and useful feedbacks.

Our great gratitude goes to Martin Bäumer for proof reading our texts and providing us with useful feedbacks and comments.
CONTENTS
SUCCESS FACTORS IN BUILDING AND MAINTAINING TRUST AMONG GLOBALLY DISTRIBUTED TEAM MEMBERS ................................................................. 1

ABSTRACT .......................................................................................................................................... 1

ACKNOWLEDGEMENTS .................................................................................................................... 2

CONTENTS .......................................................................................................................................... 3

1 INTRODUCTION ........................................................................................................................... 6
  1.1 STUDY AREA .......................................................................................................................... 6
  1.2 MOTIVATIONS ....................................................................................................................... 6
  1.3 STUDY TYPE .......................................................................................................................... 7
  1.4 REPORT OUTLINE ............................................................................................................... 7

2 BACKGROUND ............................................................................................................................. 8
  2.1 GLOBAL SOFTWARE DEVELOPMENT ............................................................................... 8
    2.1.1 The Definition of (Globally) Distributed Team .............................................................. 8
    2.1.2 Major Challenges in Global Software Development .................................................... 8
    2.1.3 GSD Challenges Relating to Trust .............................................................................. 10
  2.2 THE IMPORTANCE OF TRUST IN GSD ............................................................................ 11
  2.3 TRUST .................................................................................................................................. 12
    2.3.1 The Definition of Trust ................................................................................................. 12
    2.3.2 The Definition of Building Trust ................................................................................ 13
    2.3.3 The Definition of Maintaining Trust .......................................................................... 13
  2.4 RELATED WORK ................................................................................................................. 13
    2.4.1 Causes of Lacking and Losing Trust ............................................................................ 14
  2.5 IDENTIFIED IMPROVEMENT OPPORTUNITIES .................................................................... 15

3 RESEARCH DESIGN AND CONDUCT ......................................................................................... 16
  3.1 AIMS AND OBJECTIVES ....................................................................................................... 16
  3.2 RESEARCH QUESTIONS ....................................................................................................... 16
  3.3 RESEARCH METHODOLOGY .............................................................................................. 16
    3.3.1 Exploratory Study ......................................................................................................... 17
    3.3.2 Grounded Theory ......................................................................................................... 17
  3.4 EMPIRICAL STUDY .............................................................................................................. 17
    3.4.1 Data Collection and Analysis ....................................................................................... 17

4 RESEARCH RESULTS ................................................................................................................... 23
  4.1 RESULTS OF GROUNDED THEORY ............................................................................... 23
    4.1.1 Management Areas ........................................................................................................ 24
    4.1.2 Threats .......................................................................................................................... 24
    4.1.3 Practices ........................................................................................................................ 25
    4.1.4 Discussions ................................................................................................................... 25
  4.2 RECOMMENDATIONS .......................................................................................................... 25
    4.2.1 Global Software Development ..................................................................................... 26
    4.2.2 Software Development ............................................................................................... 26
  4.3 DISCUSSIONS ....................................................................................................................... 25
  4.4 VALIDITY THREATS ............................................................................................................ 39
    4.4.1 Internal Validity ............................................................................................................. 39
    4.4.2 External Validity ............................................................................................................ 40

5 CONCLUSIONS .............................................................................................................................. 42
  5.1 ANSWERS TO THE RESEARCH QUESTIONS ..................................................................... 42
  5.2 PERSONAL OBSERVATIONS ............................................................................................... 43
  5.3 FUTURE WORK ...................................................................................................................... 43
Table of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GSD Challenges, Adapted From [65]</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Summary of Participant Organizations</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Summary of Participant Project Managers</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>Interview Design, Conduct, Transcript, Analysis Approach</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>Relationships Between Categories in Axial Coding</td>
<td>23</td>
</tr>
<tr>
<td>6</td>
<td>SD, GSD, Trust Overlaps of Recommendations</td>
<td>26</td>
</tr>
<tr>
<td>7</td>
<td>Map Between Organizations and Recommendations 1-25</td>
<td>35</td>
</tr>
<tr>
<td>8</td>
<td>Map Between Organizations and Recommendations 26-45</td>
<td>35</td>
</tr>
<tr>
<td>9</td>
<td>Map Between Threats and Recommendations</td>
<td>36</td>
</tr>
<tr>
<td>10</td>
<td>Number of Recommendations in Different Categories</td>
<td>36</td>
</tr>
<tr>
<td>11</td>
<td>Map Between Recommendations and Categories</td>
<td>37</td>
</tr>
<tr>
<td>12</td>
<td>Categorizing of Recommendations</td>
<td>38</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

The tendency to “outsourcing”, “off-shoring”, and “near-shoring” [71] is growing in software engineering. This is mainly due to significant benefits associated, such as shortening the development time by benefiting from “follow-the-sun” software development [17][72]; closeness to market; and accessing large pool of skilled developers.

These also increase the popularity of Global Software Development (GSD) [1][2][16]. GSD is both promising and challenging since many risks are also associated with distributing tasks among teams of developers located in geographically disperse places far from each other who have different cultural background and social norms. The basic problems in GSD are addressed to be related to communication, coordination and control since traditional in-house mechanisms do not work well for distributed teams [1][9].

One of the major consequences of these problems in GSD is recognized to be difficulties in building trust among disperse team members and sustain it afterwards. The main reason could be lack of teamness feeling between team members since they do not meet each other [72].

This thesis study aims to provide a set of recommendations to address trust building and maintaining issues in GSD environments. Therefore an exploratory study was planned to conduct survey in some software organizations in order to collect rich data through semi-structured interviews. The grounded theory was applied in data analysis process to find similarities in data and to identify patterns. The outcome of the study is a set of recommendations mainly for project managers in software organizations involved in GSD.

1.1 Study Area

The study area for this thesis is Global Software Development (GSD). GSD is rather a new concept that has appeared and developed in the past two decades. It follows other industry trends in globalization, and it heavily relies on development of technologies, especially in communications. It is a specific area, where people with either same or different culture or backgrounds are put together over a physical distance to cooperate, innovate and solve some problems.

As a consequence, one of their biggest challenges then becomes overcoming these distances. This physical separation also introduces many new problems that did not exist before in traditional in-house developments, such as lack of face to face meeting. In software development, it becomes a mixture of both human and technology related issues. The key for successfully completing these GSD projects suddenly lays in human relationships between everyone involved in development.

One of the major properties of a relationship between individuals has been identified to be trust which can potentially alleviate the communication, coordination and control problems in GSD. Although the role of trust in the success or failure of software projects is clarified [19], it is not valued enough in planning and scheduling the GSD projects. The presence of trust in successful projects is hidden and may not be easily noticed while its absence obviously troubles communications, coordination and control of the project and as a result many GSD projects fail [18][19][20].

In this thesis study, trust in GSD context is studied concerning its early establishment and then sustaining activities during the project development.

1.2 Motivations

Trust has been reported as an indicator of success or failure of partnerships, strategic alliances, and networks of firms [1][27]. Moreover, trust establishment and sustaining is considered to be very crucial for all business relationships because it enables more open
communication, increased performance, higher quality deliverables and greater satisfaction in the decision-making process [27].

Therefore, it is critical for global project managers to identify potential trust related issues early and to find out proper strategies to prevent them from occurring. In addition, a set of recommendations for building and maintaining trust among distributed team members helps GSD managers to select practices which best suits their own needs. Then selected practices can be utilized in order to establish and maintain trust in the remote collaborations.

1.3 Study Type

The primary focus of this study is to discover successful industry practices from different software organizations which are used to build and maintain trust among distributed team members. Our aim is not to compare these practices, but rather to highlight the good ones that can be suggested to other software organizations, thus the outcome of this study is a set of recommendations derived from successful industry practices. The study consists of literature review and exploratory study for collecting valuable information both from research literature and software industry. We conducted semi-structured interviews in the participating organizations to collect rich and detailed data regarding the topic, complying with the exploratory nature of this study [29]. The research design and methodology is discussed in more detail in section 3.

1.4 Report Outline

Chapter 2 provides an overview on Global Software Development (GSD) in detail. It deeply discusses the major challenges in GSD and their origins. Further, the definition for the key terms used in this report such as trust and globally distributed team are given. This chapter also summarizes the related work in the study area and identifies the improvement opportunities in the current research.

In chapter 3 details on planning and conducting the research is presented. It motivates the selected design and research methodology and gives details on the research design and conduction including data collection and analysis. It also reflects how the study was planned and conducted. Furthermore, the validity threats to the research are discussed in this chapter.

The results of the research are presented in chapter 4 and a set of recommendations is proposed which is the outcome of the study.

Chapter 5 concludes the research by evaluating the research and its outcome and bringing a discussion in the study area. It also draws paths for new research efforts.
2 BACKGROUND

This section summarizes the background on trust issues in Global Software Development (GSD).

2.1 Global Software Development

Many organizations have started considering in “outsourcing”, “off-shoring”, and “near-shoring” [71] which are seen as main components of a new global paradigm [1][16][36][37][38][39][40].

The main reasons for this increasing interest are to shorten the delivery time arising from “follow-the-sun” software development [17][72]; to increase quality of software; closeness to market/customer; to use local skilled people; to save development costs; innovation and shared best practice [73]; and also marketing benefits of globalized presence.

Therefore, Global Software Development (GSD) [also known as Global Software Engineering (GSE) and Globally Distributed Software Development (GDSD)] has become the key trend in the area of software engineering and its popularity is being increasing [1][2][16].

Although there are many significant benefits associated with GSD, studies also show that these benefits are not completely achieved in the real work settings [28]. Organizations involved in GSD should be aware of the associated risks as well. For example pure “follow-the-sun”, where tasks are passed around daily between teams that are many time zones apart, seems unrealistic [28]; and sharing best practice among cultures may also be problematic when people feel they are giving away their competitive advantage to the others [28].

Regardless of the growing importance of GSD, many challenges and issues are reported [1][9]. One of the significant problems is that communication, coordination and control mechanisms which work effectively in in-house projects are not efficient enough in GSD environments, thus performance of distributed teams may decrease comparing to collocated teams [1][9]. The reasons for the performance decrease can be categorized into geographic, temporal, and cultural distances [17]. To overcome challenges in GSD which are brought in by distances, different approaches and solutions must be discovered.

GSD is characterized by stakeholders from different nationalities, cultural backgrounds, and organizational cultures who are located in different geographic locations and different time zones. They use information and communication technologies to collaborate. These conditions introduce major challenges regarding team communication, coordination, and control [74].

2.1.1 The Definition of (Globally) Distributed Team

The term Globally Distributed Teams has a wide meaning and thus can be used differently in several contexts. In this study we use Globally Distributed Teams as different groups of co-workers, separated from each other by physical distance over the national borders. Here, Distributed Teams differs from Globally Distributed Teams by being separated within the national borders.

2.1.2 Major Challenges in Global Software Development

The challenges of GSD arise from geographical, temporal and cultural distances. These concepts and the consequences are explained in more detail in the following.
2.1.2.1 Geographical Distance

In collocated teams, managers can evaluate the progress either by observation or “Management by Walking Around” (MBWA) which is not applicable on globally distributed teams [40]. Collocated team members trust each other easier and faster since they meet each other and work closely together and have informal communications and information exchange [40]. Dividing functional areas or departments of an organization across the globe introduces communication and coordination overhead to the organization. It also reduces informal communications which can hinder the development of a sense of “teamness”; establishment or sustaining of trust; and the spread of important information about the project [72].

2.1.2.2 Cultural Distance

Distributed teams consist of people from different countries with different cultures, communicational behaviors, management styles, response time, attitudes, commitment, life style, working style, thoughts, and beliefs. These differences might cause misunderstandings and misinterpretations which hinders the projects’ success rates. Cultural differences significantly influence how developers interpret and respond to certain situations [74]. Moreover, linguistic differences introduce misunderstandings [77]. Therefore, they hamper effective communication and coordination in GSD. Different activities are reported in the literature to alleviate negative impacts of cultural differences such as: different cultures in a team understand customs and values of each other [41]; face to face meetings when it is emergent need; trainings on organizational and national culture; defining and using predefined terms; improving language skills; and producing and sharing knowledge regarding cultures issues and customs [42].

2.1.2.3 Temporal Distance

It is also addressed as “time zone difference” in the literature [44]. Organizations which are located in time zones with large time difference face more problems in communications rather than organizations located in closer time zones [44]. It reduces overlapping hours of possible collaboration and can delay feedbacks from remote colleagues [66]. Temporal distance can be reduced by using synchronous and asynchronous communication channels [43]. Synchronous communication has higher level of richness than asynchronous. Although utilizing asynchronous communication tools may not adequately handle ambiguities [75], and increase the risk of misunderstandings [76], they seem to be the best for organizational units with high temporal distance [39][46].

As it was already discussed, cultural, temporal, and geographical distances bring further challenges into the GSD area. The major consequent challenges are described below.

**Loss of Teamness:** Distance creates problems for distributed teams like loss of cohesion and trust building. Moreover, different development processes [45], organizational standards, organizational cultures and policies also make communication and collaboration among distributed teams more difficult. Thus, teamness is missing in GSD. Effective utilization of proper communication and collaboration tools can lead distributed teams to success in great extent. Therefore, proper trainings and introduction sessions at the beginning of a project are suggested for building trust which creates teamness among globally distributed teams [41].

**Coordination and Control:** Coordination is the activity through which different tasks of each organizational unit are integrated so that the units contribute for setting goals and objectives [43]. In addition, coordination is the working relation with other team members because about 70% of each developer’s time is usually spent on working with other team members [40]. That is, without proper coordination, it is difficult for organizational units to function effectively [43]. Control, both formal (such as budget or guidelines) and informal
(such as peer pressure), is a process of adhering to goals, policies, standards or quality levels. It is considered in many cases that the control has blended together with the coordination [43]. Distance between working teams in GSD does not let managers to evaluate the project status realistically through observation or “Management by Walking Around” (MBWA). Thus, the remote team should report the progress of the work and also the issues which are facing freely to the managers.

**Loss of Communication Richness:** The main obstacles in effective communication among globally distributed teams are distance, different cultural backgrounds, different spoken languages, and availability of effective technology infrastructure [44]. The success of geographically distributed units directly depends on the communication and coordination infrastructure [39]. The communication can be formal/informal and synchronous/asynchronous depending on the organizational setup. Frequent face to face communications in collocated teams is an advantage. However, cost saving strategies in GSD does not let team members to travel between sites and meet [31]. Hence, organizations use technologies like video/audio conferencing, chatting, telephone calls, and emails to communicate with the remote team members. Proper utilization of these communication channels assists project managers to improve trust and commitment among team members and to reduce misunderstandings as a result [39].

The next step is to relate the communication, coordination, and control problems to the context of this study. Each challenge has been expanded in more detail in related to the research area in the followings.

2.1.3 GSD Challenges Relating to Trust

Current research in the area of GSD mainly aims at exploring the basic problems and issues. The literature on GSD is mainly focused on technical aspects and operational mechanisms as a key for a successful GSD project [36].

On the other hand, the majority in the current research is of the exploratory nature aimed at identifying different kinds of difficulties related to GSD [64]. As we discussed in the section 2.1.2, several case studies have reported different kinds of challenges and issues as a direct consequence of the unique properties of GSD’s environment settings.

To be able to understand trust-related issues, we need to take a closer look at the major challenges identified in current research. As mentioned in the section 2.1.2, temporal, geographical, and cultural distances cause challenges in communication, coordination, and control of GSD software projects. Therefore, in this thesis study, we mainly focused on these three most challenging aspects of GSD in connection to trust establishment and maintenance.

2.1.3.1 Communication

Communication is a complex issue that has great impact on trust. It is believed to be one of the main factors of lacking trust in GSD teams [1].

The richness and the amount of communication are greatly reduced in comparison to traditional in-house teams [66]. Therefore, communication can become very difficult [67], inefficient and infrequent [68]. Direct channels between remote developers must exist in order to avoid problems such as bottlenecks and delays [66]. The main challenges that affect communication are cultural, linguistic and temporal distances [67][8][3][1], and lack of face to face communication as the richest communication channel [1].

There is a general belief that the encouragement of informal communication is a must, since the social aspect of interpersonal and inter-team relationship is established through informal communication [59]. Communication appears in two different forms; synchronous and asynchronous. The former one is a direct communication between parties and the typical examples are phone calls, face to face conversations and video conferencing. The latter one appears in a form of emails, or letters. It is important to mention one more time that the asynchronous communication increases delays in communication [68][69]. The impact of these delays on trust can be significant, thus balancing between synchronous and
asynchronous communication channels should be considered as important [39]. Using asynchronous communication methods as primary methods can be a stumbling block for dispersed teams [1].

2.1.3.2 Coordination

Traditional social and cultural norms cannot be utilized to influence the attitude and cooperation between remote team members [59]. As a consequence, some distributed software teams rely on standardization as a method to compensate for the lack of rich communication between members of these teams [64]. However, disparities in work practices can easily appear in such team. Lack of balance in choosing coordination mechanisms can have negative effects on both coordination of the distributed project and the remote team’s performance [64]. In [64], it is shown that this can lead to increased direct supervision as a result, affecting the overall trust in a negative way. This negative impact on trust can also appear as a consequence of low coordination effectiveness, which is shown to be reduced by inappropriate communication [43].

2.1.3.3 Control

Project control can be a challenging task even for in-house development teams and their managers. A number of tools and techniques exist to support managerial tasks. Besides that, managers are often getting advantage of their physical presence and are able to observe their teams by walking around (MBWA). On the other side, the distance creates difficulties for project control and coordination in GSD environments [43]. Thus, the remote team should report the progress of the work and also the issues which are facing freely to the managers. And for this purpose, trust should be created and maintained among local and remote team members. Control should be performed with care.

Constant monitoring is one of the consequences of increased control due to misperception or lack of trust in remote team [1]. Manager’s desire to control is also one of the outcomes of mistrust, which can put the remote team into self-protectiveness [1]. It is important to mention as well that trust can be negatively affected by inappropriate control mechanisms, as for example those ones related to behavioral control [70]. There are many negative effects of too much or too little control, but in our study we will focus only on those effects which are related to trust.

Major GSD challenges are summarized in Figure 1. Dimensions of distance are temporal, geographical, and socio-cultural which influence communication, coordination, and control in global project management.

2.2 The Importance of Trust in GSD

Distributed teams are spread across time, geographical, and cultural distances. They are working under difficult time and cost constraints that hinder coordination and control [57]. Hence they must rely on and heavily tie together through trust. Trust has been identified as an indicator of success or failure of partnerships, strategic alliances, and networks of firms [1][27]. It has been suggested that trust is crucial for all business relationships as it enables more open communication, increased performance, higher quality deliverables and greater satisfaction in the decision-making process [27].

When team members are co-located, familiarity and relationship is developed both informally and through task-related activities [59]. Distance is a barrier in distributed team communication and cooperation which hinders trust building and maintenance among distributed team members. Therefore, it is crucial for project managers to identify proper strategies to address trust related issues in GSD project due to crucial impact of trust in the success and the quality of the projects.
2.3 Trust

This section deeply explains the context of trust used in this study. Important definitions of trust and trust-related concepts and expressions are also included in this section. The main sources of these definitions are found in the research field of social sciences; as the concept of trust must be understood in such context in order to be properly addressed in the field of GSD.

2.3.1 The Definition of Trust

Trust has been recognized as a multidimensional concept at different levels such as group, organization, and society in the literature [78]. In this study, relational trust among team members is focused which is defined as “the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party” [25].

The relational trust incorporate both rational and social components, meaning that “trust needs to be conceptualized not only as a calculative orientation toward risk, but also a social orientation toward other people and toward society as a whole” [39]. This implicates that trust has been viewed as a property of a relationship between parties, not as a property of individuals [56]. The logically assessed component of trust is recognized as cognitive based trust [59], and the social component is called affective based trust. However, empirical studies on reciprocity of trust are very rare and it is still not well known how one party’s trust affects the other party’s trust [88]. Due to this limitation we assume that one party’s trust is fully reciprocal to other party’s trust, as it was defined previously.

Relational trust is also addressed as interpersonal trust in the literature with the following definition: “the extent to which a person is confident in, and willing to act on the basis of, the words, actions, and decisions of another” [79]. Interpersonal trust has cognitive and affective elements [80].

Cognitive based trust is related to the rational characteristics of the trustees that include reliability [79][85], responsibility [81], integrity, and competence [25]. This element has been mainly studied in the context of working groups as a need to reduce the complexity between social actors [82], for example in a surgery operation a patient trusts the doctor to...
perform the operation professionally and at the same time the doctor has to rely on assistant staff to perform different tasks reliably as well. This trust will increase if trustee performs promised tasks professionally and on time. Therefore, cognitive based trust depends on information which has been collected in communications. The highest level of cognition based trust is when “social actors no longer need or want any further evidence or rational reasons for their confidence in the objects of trust” [80].

**Affective based trust** is related to the emotional and social skills of trustees. This element is considered to be important in the context of close social relationships like partnership and family [83]. Here, people share and talk openly about any problem with others since they are known to be caring and a good listener. The cognitive based trust in working groups contexts appears when a team member takes another member’s problem as his own and gives help even without been asked [79]. As a result, the performance of the team will be increased [79].

It should be mentioned that in different contexts, the importance of one element could be greater than the other one. For example trust building and maintenance in temporary work contexts depend more on the cognitive element rather than the affective [84] while affective based is given more importance than cognitive in close social relationships.

### 2.3.2 The Definition of Building Trust

As the definition of trust for this study contains both logical (cognitive) and social (affective) components, building trust requires both of them to be considered. Therefore, a set of activities is considered as trust building, when both cognitive and affective trust are created.

### 2.3.3 The Definition of Maintaining Trust

Assuming the existence of trust which has been already built, maintaining trust consists of a set of activities that aims at preserving or improving trust, considering both its cognitive and affective elements.

### 2.4 Related Work

An indicator of success or failure in GSD is believed to be trust [18][19][20] due to its severe impacts on performance of people, schedule, rework, and communications [1][2]. Geographical, temporal, organizational, cultural, and political differences [21][22][23][24], and distance [17] are reported as main obstacles in establishing and maintaining trust among distributed teams. Furthermore, techniques and methods for building or maintaining trust such as face-to-face meetings, active communication, and socialization which are commonly used in in-house development are not applicable in GSD due to its cost saving strategies [1].

The following summarizes the previous research work in existing literature which is partially or completely related to the topic and some of them can be indirectly used for trust establishment or maintenance purposes. This information is collected from different reliable research papers. The summary is presented in different categories based on the content of the research.

**Trust:** the importance of trust is emphasized in [1] and the negative effects of losing trust are discussed. There is also a study [58] that has explored the challenges of creating and maintaining trust in a global virtual team. The role of trust in managing client-vendor relationships and the critical trust factors are reflected in [56] from the perspective of software outsourcing practitioners.

**Causes of Lacking or Losing Trust:** key causes of lacking or losing trust are identified in [1][2][8] which are explained in more detail in section 2.4.1.

**Software Development Models:** efforts and results of adapting scrum/agile processes are reported in GSD [4][5][12].
Education and Training: the role of prior education and university courses for students in succeeding in GSD positions is explored in [13]. Further, the positive effects of training in building trust are emphasized in [6].

Tools: the influence of managing adaptation of information and communications tools in improving team trust and cooperation is also brought to discussion in [33].

Trust Building Approaches: bridging technique is suggested in [3][31]. The role of bi-culturals (people who have deeply internalized more than one cultural profile) in intercultural collaboration and communication and trust building is studied by [30]. Furthermore, the role of dual identity immigrant managers in effective collaboration and trust building is focused in [35]. In [32], the effect of openly recognizing cultural differences and intentionally strengthening social ties among team members in building trust in distributed software teams is examined and the effect of proper management/leading style on building trust is explored in [34].

Trust Maintenance Suggestions: liaisons technique is proposed in [11]. Simulation technique is also suggested by [7] for improving trust. Further, a “Shared Project Context” model is explained in [9] to address the trust related issues.

Trust Building and Maintenance Suggestions: The dynamic nature of trust and the differences between high- and low-performing virtual teams in the changing patterns in cognition- and affective-based trust over time (early, middle, and late stages of project) is examined in [19].

The results of an empirical study on software outsourcing relationships shows that cultural understanding, creditability, capabilities, pilot project performance, personal visits, and investment are the important factors in building trust [27]. In addition, communication, cultural understanding, capabilities, contract conformance, quality, timely delivery, development processes, managing expectations, personal relationships, and performance are reported as maintaining trust factors [27].

A case study in outsourced IS development projects has resulted in identifying initial interactions, integrity, predictability, communication, sharing control, concern for others, joint identification, commitment, potential for success, and managerial decisions as trust building mechanisms [57].

A theoretical model is proposed [59] in order to suggest different actions to take place in different stages of team development that lead to creating and sustaining trust among virtual teams.

2.4.1 Causes of Lacking and Losing Trust
There are rather small amounts of research directly related to the main causes of lacking and losing trust in GSD environments. The majority of researchers were focusing on major challenges in GSD.

These small amounts of research that we were able to find are all case studies and exploratory in nature. As a result of that, we were only able to consider their findings as related to their particular cases. However, we discovered certain patterns that were interesting for our study and made us able to include these findings in our study process. The findings from these researches are summarized with systematic review and the rest of this section will present these findings.

First of all, it is important to mention the criteria that were used for searching and selecting appropriate research material. It was important to us, in the first place, that research area is GSD (terms and abbreviations such as GSE or GDSD are used in some literature). A research should be done on a setting of at least two (Globally) Distributed Teams according to our definitions. Moreover, it should be done in industry and trust should be mentioned in the full text. In this way we have assured that search results closely fit to our scope. Other criteria that might be important for some other GSD studies were not considered in the search. Examples of such criteria are: size of teams; if teams are distributed globally or not (according to our definition); the research methods used. By having few criteria we aimed at
achieving broad overview of the matter. Our findings should then be applicable to a wide spectrum of GSD team types and settings.

At last, it is important to mention that the search included the material related to conference proceedings and journals such as IEEE Software and Communications of ACM. The search resulted in 13 articles, while the final amount of related material after reviewing each search results was 5. The systematic review results from our materials [64][1][59][2][8] have identified following causes of lacking and losing trust in GSD environments:

- Poor socialization
- Socio-cultural fit
- Unpredictable communication
- Lack of face to face meeting
- Reduction of communication
- Lack of language skills
- Inconsistent work practices
- Increased monitoring and control
- Lack of conflict handling
- Lack of cognitive-based trust
- Fear of losing job
- Competitive reward system
- Distances
- Lack of teamness
- Lack of informal communication
- Delay in response
- Reduced synchronous communication

The identified causes are not considered as distinct categories. They can be combined to another one, or they can have a relationship to each other, while each of them contains its unique property. An example that can illustrate this is following: Lack of language skills is found to be a cause of delays in written communication, which resulted in too little (Reduction in communication) and unpredictable communication and loss of quality (unique property) of exchanged information [1]. Moreover, a reduction in communication does not have to be caused by a lack of language skills. It can be a consequence of, for example, poor socialization or socio-cultural fit.

2.5 Identified Improvement Opportunities

Although a body of knowledge has been established for GSD, the art and science of GSD is still evolving [10] since it should be transferred into a mature discipline [10][14] i.e. by establishing conventions for how remote teams communicate and work together [9]. Since published research on GSD is diverse usually in form of conducted case studies, generalizations have rarely been done on results and findings [15]. Therefore, there is a need to summarize progress in GSD to identify areas that needs further investigations. As a result, commonalities in GSD can be found [15].

However, current research is mainly identifying challenges in GSD than providing solutions as we discussed in section 2.1.2 and section 2.4. In case of suggesting any model, framework, or tool there is no study on its practical applicability.

Among the identified areas for further research, in this thesis, we focus on trust concerning how to build and maintain it by suggesting a set of recommendations. As to our best knowledge, there are few research addressing trust building and sustaining activities. However, those research do not clearly specify their context, thus we could not verify or assume that the context is the same as for our study. For this reason we were not able to consider those researches in our study.
3 **Research Design and Conduct**

This section describes aims and objectives of the research, research questions, and expected outcomes. It goes ahead with explaining the research methodology and data collection design. In addition, the risks associated with the study are discussed at the end of this section.

### 3.1 Aims and Objectives

The aim of this thesis is to provide a set of recommendations that assists building and maintaining trust among globally distributed team members. In order to fulfill this aim, the following objectives are outlined:

- To identify the main causes of lacking trust among globally distributed team members
- To identify the main causes of losing trust after its establishment
- To gather existing knowledge and experience from both research (theoretical), and industry (practical)
- To discover helpful practices, methods, or techniques that address previously identified main causes
- To classify identified practices according to the causes of lacking and losing trust

GSD organizations can use the offered recommendations as an advisory help in creating or managing their distributed teams, addressing the establishment and maintenance of trust as a fundamental key of success.

### 3.2 Research Questions

In order to achieve the objectives explained before, the following questions shall be addressed properly:

1. What are the main causes of lacking trust among globally distributed teams?
2. What are the main causes of losing trust?
3. What practices for building/maintaining trust have been reported in the existing literature?
4. Which practices have been successfully applied in industry to overcome the trust building difficulties or to prevent from losing trust?
5. Is there any action, or combination of actions, that can serve as a substitute for building/maintaining trust through face-to-face communication?

### 3.3 Research Methodology

Three phases were planned and conducted in order to answer the research questions and cover the aim of the research.

**Phase 1:** It included a detailed literature review to find main causes of lacking and losing trust among globally distributed teams. Previous research was also summarized and best practices that improve building/maintaining trust in literature were identified. Furthermore, several companies were contacted and negotiated in order to find volunteers among them to participate in the research.

**Phase 2:** The data from the literature review was analyzed and used as a guide to conduct interviews with project managers. The purpose of conducting interviews in the participating organizations was to gather valuable information which was required in
establishing a set of recommendations as an outcome of the study. Some interviews revealed excellent practices and addressed existing or potential problems which were not focused before.

**Phase 3:** In this phase, the data collected from the comprehensive literature review and interviews was analyzed. As a result, a list of recommendation was suggested to fulfill the purpose of the study.

In the following sections, more details about the design and implementation of the research are given. Section 3.4 discusses the design and conduction of the empirical study which was the basis for extracting a list of recommendations.

### 3.3.1 Exploratory Study

This study is designed as an exploratory in nature [61]. An exploratory study is used when not much is known about the area or not much information is available on how similar problems have been solved in the past [55]. In such cases, extensive preliminary work is needed to get familiar with the situation and understand what is occurring before designing the research and developing a model [55]. In essence exploratory studies are undertaken to better comprehend the nature of the problem since very few studies might have been conducted in that area. Extensive interviews with many people might have to be conducted to get a handle on the situation [55]. Some qualitative studies where data is collected through observation or interviews are exploratory in nature. When the data shows some pattern, theories are developed and hypothesis formulated for subsequent testing. Exploratory studies are also necessary when some facts are known but more information is needed for developing a viable theoretical framework [55].

The exploratory nature of the empirical studies was helpful for this research to achieve its goal by analyzing the similarities and differences among the cases that have similar traits [62]. The primary focus of the study was on discovering the practices which are currently used by different organizations in order to build and maintain trust among distributed team members, not on making comparisons between different case studies.

### 3.3.2 Grounded Theory

Grounded Theory is used as a basis in this study. It examines the actual data of the real world and analyses the data with no preconceived hypothesis [86]. Data collection is usually but not exclusively done by interviews and data analysis results in finding out the concepts behind the actualities by looking for codes, then concepts and finally categories [86]. It is very well suited for exploratory investigations when there is no prior knowledge of a part of reality or a phenomenon [87]. Grounded theories will be drawn from the collected data. That is why they can offer insight; enhance understanding; and provide a meaningful guide to action in a specific study area [60].

In order to be able to propose recommendations, data was systematically gathered and analyzed. The data was gathered from a variety of sources, including qualitative interviews and enhanced analysis of related research literature.

### 3.4 Empirical Study

In this chapter, the design and conduction of the empirical study part of the whole research is explained in detail.

#### 3.4.1 Data Collection and Analysis

Due to the qualitative nature of the research, we used semi-structured interviews for conducting survey in software industries involved in GSD. NVivo 8 was used as a tool for data storage and management. Finally, in data analysis grounded theory was applied on collected data to create the results of this study.
Semi-structured Interviews: there are three types of interviews namely structured, unstructured, and semi-structured interviews. Structured interviews are used when the interviewer tends to ask questions in “Yes-No” form. The interviewee is the source of both questions and answers in unstructured interviews because a lot of discussion is made broadly on the intended issue/topic which yields useful relevant information. In semi-structured interviews, both structured and unstructured interviews approaches are adopted. For this study we used semi-structured interviews with a sufficient number of participants to collect rich and detailed data from project managers with open questions, complying with the exploratory nature of the study [48][62][29]. A semi-structured interview is a method of research used in social sciences. While a structured interview has a formalized, limited set of questions, a semi-structured interview is flexible that allows new questions to be brought up during the interview as a result of what the interviewee says [61][62]. The interviewer in a semi-structured interview generally has a framework of themes to be explored. Interviews reflect the interviewee’s experience and opinion regarding the problem area [49]. Furthermore, they help identifying and investigating the industrial practices for the intended problem [49].

We conducted 10 interviews in 6 different software companies with flexible schedules so that interviewees could make an appointment at any time suitable for them [50]. The organizations develop different type of products with different organizational setting and structure located in different countries. All interview times were given by the interviewees that were quite flexible and comfortable for them. We asked them for one-hour interview and tried to ask as many important questions as possible in the interview session.

All interviewees were contacted by email well in advance. They were provided with all project-related material in order to familiarize them with the research, and to increase their cooperativeness and make them comfortable during the interview process [50]. The interviews were documented immediately after conduction. Afterwards, the value of information in weak statements was reevaluated at most three times, after which they get rejected if a satisfactory information value level is not reached. Ambiguities and uncertainties were noted down and then discussed again with the interviewees. Finally the improved transcripts with clear text were sent back to the interviewees for approval.

Grounded Theory: In alignment with the exploratory nature of this study, grounded theory was selected as the most appropriate strategy for data collection and analysis. Grounded theory building developed by Glaser and Strauss [86] was used as the basis for the study in which theory is generated from observation by a qualitative approach [60].

Success factors and practices regarding trust establishment and sustaining in GSD projects were extracted by systematically collecting and analyzing data. Data sources for building the theory were basically from qualitative interviews with project managers who had experience in GSD; journal articles; papers from conference proceedings; and books in GSD.

Data from 5 research articles, 2 books, and 10 interviews were input for starting the grounded theorizing. Nvivo 8 was used for data storage and analysis in a way that each interview transcript was added to the data base to keep the history and comments for traceability purposes.

Data analysis was performed according to principles prescribed by grounded theory through applying open, axial, and selective coding techniques [60], also called as theoretical sampling.

Finally, the analysis is done using NVivo 8 tool. Data from all interviews is analyzed in this tool according to the grounded theory. The resulting codes were re-checked for consistency and clearness before proceeding further for constructing the final outcome of this study in a form of recommendations.
3.4.1.1 Participants

The participants of this study were managers working in different companies involved in GSD, located in different countries i.e. Malaysia, Iran, Serbia, Sweden, and South Africa. Availability of participants was criteria for the selection [62].

Both researchers studied companies in Sweden by reading their websites to prepare a list of GSD companies in order to send an invitation email to encourage them to participate in the research. Only two organizations replied the email out of 60 which were consultancy companies rather than being involved in GSD. Therefore, the next step for the researchers was contacting managers and developers outside Sweden and also to get help from researchers’ and supervisors’ personal contacts. Some interviews were conducted via Skype and some through a face to face meeting depending on distance and manager’s preference.

The basic information about the research participants is presented in this chapter, with a brief background on their experience and area of expertise. The summary of each company and project manager can be found in Figure 2 and Figure 3.

3.4.1.1.1 Organization 1: Company X, Malaysia

We were requested not to mention the exact name for our participating organization in Malaysia, thus we will refer to it as Company X. From this organization we have interviewed two managers who are working on different projects.

Manager 1 in Kuala Lumpur: He has been in a manager position for seven years, of which two years in global software development. His local team is cooperating with two other globally distributed teams, in USA and Iran. We have collected their practices from the project in which they were developing USB protocol analyzer.

Manager 2 in Kuala Lumpur: The experience of the second participant from the same organization is five years in GSD management. As for the previous participant, his local team was also working together on the same project with two teams – in USA and Iran. The product that they were developing is USB protocol exerciser.

3.4.1.1.2 Organization 2: Flextronics, Sweden

Flextronics is a large multi-national IT company, with 30 offices around the world and around 200 000 employees. The company has been practicing global software development for many years. Both of our participants from this organization are working at the office in Karlskrona, Sweden. Flextronics holds several ISO certificates for different products such as ISO 900X, ISO 13485, and ISO14000.

Manager 1 in Karlskrona: Our first participant from Flextronics is a manager with ten years of experience in global software development. Information for the interview was given from the recent project, where the local team has, in cooperation with other company, developed a wireless communication product. Their remote team was a part of Ericsson, distributed inside the national borders.

Manager 2 in Karlskrona: The second participant from the same organization was involved in development of a medical care product. Her experience is around eight years in management, from which two years in global software development. Her local team was cooperating with remote teams in Ukraine and Switzerland.

3.4.1.1.3 Organization 3: Troxo, Serbia

Compared to other participating organizations, Troxo is a young and smaller company of around 30 employees, with headquarters in Sweden and development office situated in Niš, Serbia. The company’s main expertise is in Web technologies, communications and media.

Manager 1 in Niš: Our interviewee’s experience in global software development is around five years. During these five years he and his local team have been working on a
large project, together with remote colleagues from another company in Sweden. They were developing solutions for ISP and hosting.

3.4.1.1.4 Organization 4: Ericsson, Sweden

Another large multinational organization that participated in our study is Ericsson, a company with a lot of experiences in global software development. It provides telecommunication equipment and services worldwide. Our two participants from this organization are from different locations, Karlskrona and Linköping, both in Sweden. Ericsson is ISO 9001:2000 certified in many areas including development, production, and management.

Manager 1 in Linköping: Our participant from Linköping office is a well experienced manager in global software development. His experience starts from year 1988. He has worked on many GSD projects, but he provided us with information regarding his last successful GSD project, where his local team has developed hardware and corresponding low level software. His remote team was in China.

Manager 2 in Karlskrona: The second participant from Ericsson is from the office in Karlskrona. Her experience as global software development is around five years. The interview with her was concentrated around development of provisioning product for subscribers in a mobile network. Her local team in Karlskrona was developing the product together with a remote team in China.

Manager 3 in Shanghai: he is project manager in the Ericsson office located in Shanghai, China. He has been involved in GSD for about nine years and for two years he is a GSD project manager. His team is developing a provisioning product for subscribers in a mobile network in cooperation with the office in Karlskrona.

<table>
<thead>
<tr>
<th>Name</th>
<th>Abbreviation</th>
<th>Country</th>
<th>Product scope</th>
<th>Outsourcing</th>
<th>Off-shoring</th>
<th>Virtual Team</th>
<th>Customer</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company X</td>
<td>CX</td>
<td>Malaysia</td>
<td>USB protocol</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Flextronics</td>
<td>FL</td>
<td>Sweden</td>
<td>Wireless, Medical equipment</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Troxo</td>
<td>TR</td>
<td>Serbia</td>
<td>Web technologies</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ericsson</td>
<td>ER</td>
<td>Sweden</td>
<td>Wireless, Mobile Networks</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sitwala Technologies</td>
<td>SI</td>
<td>South Africa</td>
<td>Telecom</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>UIQ Technology</td>
<td>UI</td>
<td>Sweden</td>
<td>System and software for mobile devices</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2 – summary of participant organizations

3.4.1.1.5 Organization 5: Sitwala Technologies, Africa

Sitwala Technologies is located near Johannesburg, South Africa. It is a company with large experience, dating from 1993. They have a strong competence in the area of complete software development lifecycles, as well as a number of other IT products. Sitwala Technologies is CMMI level 4 certified and it also holds ISO 9001:2000 certificate.

Manager 1 in Johannesburg: Our interviewee's experience in global software development dates from 1994. He shared with us his experiences from a recent project involving teams in France, Romania and India besides his local team in South Africa. They all took a part in development of a telecommunication product.
3.4.1.6 Organization 6: UIQ, Sweden

UIQ Technology is located in Ronneby, Sweden. The company develops the user interface including some applications and gadgets for Symbian-operated mobile devices. The company’s main customers are Motorola and Sony Ericsson.

Manager 1 in Ronneby: The interviewee has been involved in GSD for approximately four and a half years. He has been on a project manager’s position in around three years. The remote team for our interviewee was located in Budapest, Hungary.

<table>
<thead>
<tr>
<th>Company</th>
<th>Experience Years</th>
<th>GSD Years</th>
<th>Product Type</th>
<th>Remote Location</th>
<th>Analysis</th>
<th>Design</th>
<th>Development</th>
<th>Test</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>CX</td>
<td>7</td>
<td>2</td>
<td>USB Analyzer</td>
<td>USA</td>
<td>X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CX</td>
<td>5</td>
<td>5</td>
<td>USB Exerciser</td>
<td>USA</td>
<td>X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FL</td>
<td>10</td>
<td>10</td>
<td>Wireless telecommunication product</td>
<td>Sweden</td>
<td>X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FL</td>
<td>8</td>
<td>2</td>
<td>Medical equipment</td>
<td>Ukraine Switzerland</td>
<td>X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TR</td>
<td>5</td>
<td>5</td>
<td>Web technology product – ISP Hosting</td>
<td>Sweden</td>
<td>X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER</td>
<td>21</td>
<td>21</td>
<td>Low level software</td>
<td>China Taiwan</td>
<td>X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI</td>
<td>5</td>
<td>5</td>
<td>Telecom product, class 5 switch</td>
<td>France Romania India</td>
<td>X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER</td>
<td>15</td>
<td>15</td>
<td>Provisioning product for mobile network customers</td>
<td>China</td>
<td>X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UI</td>
<td>3</td>
<td>4.5</td>
<td>User interface, software and gadgets</td>
<td>Hungary</td>
<td>X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER</td>
<td>9</td>
<td>2</td>
<td>Provisioning product for mobile network customers</td>
<td>Sweden</td>
<td>X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3 - summary of participant project managers

3.4.1.2 Approach

The process of designing interviews took part after discovering and identifying the causes for lacking and losing trust after a comprehensive literature review. These causes were used as basis on which the interview is grounded. Each question is composed from a perspective of one or several identified causes.

The questions were not directly related to any personal matter, but rather on settings, conditions and decisions of the participating organizations. The purpose of this was to avoid biasing the research. Since no questions are addressing any personal matter, they could not directly relate to trust in any way. The information regarding trust was extracted from the information on general practices of each participating organization.

The Interview questions were designed in a way to collect relevant data and identify participants’ best practices regarding trust in GSD. It should be mentioned that the transcriptions were not included in the report for confidentiality. The list of interview questions can be viewed in Appendix A.

The criterion for selecting participants of this study was that they were involved in a successful GSD project which consisted of at least two (Globally) distributed teams according to our definition. The interviews were conducted in two ways – online meeting through Skype and in person.

The interview design has changed several times between starting the first one and completing the last one. We have observed the interviewees reactions to questions and made
changes on those who were not very clear. Those changes were mainly related to language, and made in the way that their context and meaning is preserved. We also changed the order of the questions to prevent interviewees of giving repetitive answers. These observations and changes can be described as a continuous spiral process as seen in the Figure 4.

![Figure 4 - interview design, conduct, transcript, analysis approach](image)

3.4.1.3 Risks in Conducting the Empirical Study

This study was facing one major risk under its execution, in data collection phase, which was related to the information gathering from the industry. It is the subject of other people willingness and availability to assign their valuable time for an academic research. The research has been performed in turbulent time for the IT branch, thus delays and rejections were expected to happen. By considering these facts, the researchers contacted potentially interested parties very early in the study even before identifying the data collection methods. Moreover, researchers strictly paid attention to minimize the time that participants needed to spend for the research by reviewing and refining the data collection methods in several steps in the research design and execution.

Another risk was related to the quality of data in data analysis. It was not very clear for the researchers how many software companies will show interest to participate in the survey, therefore they reviewed and refined the research method after contacting different industry considering real amount of potential data sources. The data collection was designed to be flexible and possible to change based on industry responses. In addition, more companies were contacted which are located outside Sweden to increase the number of participants and to reduce the risk of collecting too little or poor data that could not be used in data analysis.
4  **RESEARCH RESULTS**

In this section, the results of grounded theory are discussed and finally a set of recommendations is suggested to cover the purpose of the research.

4.1  **Results of Grounded Theory**

Data analysis started with an open coding. Interview text was reviewed to identify sentences about causes of lacking/losing trust, GSD challenges, and related practices. The text was labeled with proper keywords. It resulted in total of 121 codes. Similar codes were grouped together under a more general concept that made 23 concepts. Later, we grouped these concepts to make 12 categories. The following example explains in more detail how GT was used in data analysis.

**Interview Transcript X:** “Emails are used mostly because of language issues.”

**Interview Transcript Y:** “The mostly used communication method is IRC chatting. This method is also a preferred one, since it is synchronous and still enables both sides to avoid potential language issues and misunderstandings.”

The first case, addresses one of the identified causes in literature, hence we coded this statement as “Linguistic Differences”. Further, the applied practice to alleviate linguistic differences was stated as “Email”. The second case, addresses the same cause, but the practice is “IRC chatting”. Hence, this statement is coded as “Chatting”. In the next step, we grouped “Email” and “Chatting” into “Written Communication”. Later, “Written Communication” and similar concepts grouped in a more general category named “Practices”. Further, “Linguistic Differences” was grouped with other causes of lacking or losing trust and their consequences in a general category of “Threats”.

In axial coding, we noticed that many practices are inter-related. Therefore, we came up with four different management areas namely Communication, Coordination, Control, and Planning. In each management area, some activities should be performed to address trust related issues. For each of these areas, we identified several threats which were basically the causes of lacking/losing trust and their consequences. And for each threat, one or more industrial practices were found to alleviate its negative effects. Hence, the threat-practice relationship was recognized for each management area. Figure 5 presents these relationships and categorization. Further, it shows the number of practices and threats for each management area.

![Figure 5 – relationships between categories in axial coding](image-url)
We applied selective coding for systematically validating relationships and filling in categories that needed further refinement. In addition, we did not include vague statements in transcripts if we could not relate them to a specific category after three times reading through it in order to prepare rich and dependable data input for grounded theorizing. Finally, grounded theorizing resulted in 4 management area, 30 threats, and 53 practices.

The threats were collected from the literature and few more added from interviews. The literature did not consist of recommendations which fitted the required constraints under the defined settings by the authors for the dependability of articles. Therefore, the data in practices is exclusively from industry.

It should be emphasized that both practices and threats are very valuable in the findings. Threats are helpful to understand their impact, and practices can be used or adapted by different organizations. One of the major challenges in GSD is trust which is an indicator of success or failure of GSD projects [18][19][20] due to its great impacts on team’s performance and the quality of the work. There are risks and threats in building and maintaining trust which should be managed properly to abandon their negative effects. As a result, performance and quality will be increased.

4.1.1 Management Areas

The major categories identified in this study were Communication, Planning, Control, and Coordination which are directly or indirectly affected by trust. Managerial actions in projects can affect the developers’ performance and determine the success or failure of the projects. The importance of management in distributed software development was highlighted in the result of this study. Project managers should be able to make proper decisions in each area to facilitate building the “trust culture” in inter and intra organizational relationships. The most challenging areas in project management found to be communication and control. They seem to be very inter-related and complicated which impact each other. Hence, we highlight that the awareness of threats in each management area helps practitioners to consider actions to reduce the probability of threats’ realization. However, we recognized that if trust is lost during the project for any reason, it is hardly possible to be repaired or re-established.

4.1.2 Threats

Management threats differ for each organization based on their setting and structure. But in all cases, they have considerable impact on trust building or sustaining. To limit or avoid the impact of risks in GSD collaborations, project managers require knowledge on what to be aware of. Accordingly, providing information on risks and consequences for each management area supports project managers in global environment. Management threats and consequences discovered by this study are listed in the following. These threats were discussed in the previous sections in more detail.

- Increased monitoring and control
- Lack of teamness: by working
- Lack of cognitive-based trust
- Lack of conflict handling
- Lack of face to face meeting
- Inconsistent work practices
- Fear of losing job
- Lack of language skills
- Distances
- Poor socio-cultural fit
- Unpredictable communication
- Lack of informal communication
- Delay in response
• Competitive reward system
• Poor socialization
• Reduction of communication
• Reduced synchronous communication
• Poor communication infrastructure
• Unrealistic budget estimation
• Unrealistic time estimation
• Unrealistic progress evaluation
• Complexity of the project
• Complexity of task distribution
• Communication overhead
• Poor performance
• Unpredictable quality of result
• Integration problems
• Late defect introduction
• Latency in task accomplishment
• Task dependencies

4.1.3 Practices
By analyzing the data collected from semi-structured interviews, 51 practices were discovered which one or combination of them addressed one or more threat. The practices are listed and explained in more detail in section 4.2 when explaining a set of recommendations.

4.1.4 Discussions
Literature review was performed in this study and the collected data used as input to grounded theory. Its role was to “sensitizing” the researcher to address specific questions and issues. It is very important to stress that there was no hypothesis at the beginning of the study and there is a distinct difference between sensitizing and theorizing questions. Karp et al. [90] mentioned that in the following:

“Consistent with the logic of grounded theory, this study did not begin with any explicit hypothesis testing. Instead we began with broad sensitizing questions.”

However, every interview needs an agenda which must be prepared in advance and sent to the interviewee. In addition, for startup questions it was required to go through the literature. It helped researchers to ask relevant questions and limit the time for the interview and scope of answers since trust in GSD covers a broad concept.

4.2 Recommendations
To be able to extract the set of recommendations, the organizational settings and structures are not considered. However, more information about each organization is provided which can be reviewed for further investigations based on this study.

We applied GT on collected data in order to extract the recommendations. The following example elaborates the application and use of GT clearly.

Remembering the example of section 4.1, for transcript X sample, we found “Email” as a practice and “Linguistic Differences” as a threat. In transcript Y, the practice is “Chatting” for the same threat. “Email” and “Chatting” are grouped into “Written Communication”. The relationship between “Written Communication” and “Linguistic Differences”, as in our example here, resulted in a recommendation: “Use written communication to reduce the language misunderstandings”. 
On the basis of the interviews, the practices which are directly or indirectly used in industry in order to build and maintain trust used to extract the set of recommendation as follows.

Recommendations are listed under GSD and Software Development (SD) categories. For GSD related ones, it is clarified which recommendations address general issues and which ones can be considered as a solution to a certain trust related issue. The recommendations were classified based on the causes of lacking and losing trust that were explored in the literature review. They are listed under general, building trust, maintaining trust, and building and maintaining sections which shows their use and applicability area. For each, the motivation in relation to the specific causes is given.

SD recommendations are the ones which could be considered generally in any kind of software development. However, these practices are useful in GSD as well. Figure 12 presents this classification and shows how general GSD and SD recommendations can be indirectly related to trust issues.

Some recommendations may belong to more than one category since they address more than one issue. For some challenges, a combination of recommendations may be proper solution. Figure 9 shows how recommendations are mapped to threats. In addition, Figure 6 pictures how recommendations were overlapping regarding, SD, GSD, and trust areas.

![Figure 6 – SD, GSD, Trust overlaps of recommendations](image)

4.2.1 Global Software Development

4.2.1.1 General

**Recommendation 1:** “Provide mutual shared understanding of the work early in the project.”

**Explanation:** This practice avoids misunderstandings among team members. Each remote party should feel responsible to make its message understood by the other one. And they should gain the shared understanding to avoid unpredictable deliverables or latencies in the project.

**Recommendation 2:** “Provide proper communication infrastructure in cooperating sites.”

**Explanation:** Since communication is critical in any remote cooperation, there is a need to establish proper communication infrastructure between collaborating remote sites. It improves the quality of communication and helps having an effective communication. Hence, reduces the misunderstandings. However, it also improves the teamness feeling among team members by providing a facility to communicate as often as needed.
Recommendation 3: “Be always prepared for change by task redistribution and having backup plans.”
Explanation: Risk management is crucial in GSD projects in which backup plans can be made to address the potential issues which might happen in future. The better the risks are identified and addressed, the higher the quality of the result will be. In some cases, project managers need to redistribute tasks for certain purposes such as meeting schedule.

Recommendation 4: “Consider the size of the project in task distribution among remote sites in order to reduce the communication overhead.”
Explanation: In small size projects, distributing tasks among different locations may only increase the communication overhead rather than improving the development time or saving the costs.

Recommendation 5: “Get prepared for meetings in advance by distributing agenda to achieve effective communication and information exchange.”
Explanation: When communications are planned, participants in meetings can get prepared in advance. It improves the effectiveness of meetings and helps managers to address and solve more issues. Hence, it is recommended for all participants in communications to be more organized in meetings considering the limitations of face to face meetings in GSD.

Recommendation 6: “Consider distance in planning the budget, i.e. plan for necessary travels in advance.”
Explanation: In GSD collaborations, costs of travelling should be considered early in planning. Therefore, at the end GSD projects are not over budget.

Recommendation 7: “Perform risk management in collaboration with the remote site early in the project.”
Explanation: Early risk management should be done for all software projects. However, in GSD projects it is important to perform risk management in collaborating with all remote sites in order to collect all risks from all involved sites and address them early in the plan.

Recommendation 8: “Use peer reviews for early quality assurance.”
Explanation: Peer review is an effective practice to ensure the quality of the project early during the development phase in which, one remote team member is responsible to check the other team member’s work during the development.

4.2.1.2 Building Trust
Recommendation 9: “Arrange an introduction meeting either face to face or via synchronous channels at the beginning of the project i.e. a kick-off meeting.”
Explanation: In this meeting team members get familiar to each other. Therefore, they get a feeling of working in a team. Further, roles and responsibilities can be discussed in this meeting. This practice also partially addresses the lack of face to face meetings, informal communication and socialization.
Motivation: Poor socialization was reported as a cause of lacking trust in GSD collaborations. One practice to address it can be arranging an introduction meeting in which team members get to know each other. It also can facilitate future socializations among team members.

Recommendation 10: “Plan and keep a regular meeting with the remote team. It can be either face to face or held over (video) conference calls.”
Explanation: The distance in GSD projects limits face to face communication. Further, all companies have cost-saving strategies which do not let them meet remote colleagues regularly or often. Therefore, it is recommended for larger organizations with longer collaborations.

As a replacement for regular face to face meetings, it is very important to keep a regular synchronous communication. It improves the teamness and enables managers in both sites to evaluate the current status of the project and discuss the issues.

Motivation: Lack of face to face meetings is one of the major GSD issues in GSD which hinders building trust between remote team members. In order to alleviate its negative impacts, a regular meeting is recommended.

Recommendation 11: “Encourage use of video in communications.”

Explanation: The use of video in communication helps the trust building. It is not usually enough to talk to a remote person to build trust. Video makes a communication more live and facilitates the trust building. Further, it improves the teamness feeling.

Motivation: Lack of face to face meetings in GSD which is a hindrance of trust establishment can be alleviated by this activity.

Recommendation 12: “Encourage informal communications via chat or calls which are out of the plan.”

Explanation: Informal communications are very important even in collocated software development. It increases the knowledge sharing and helps trust building and maintaining. In GSD projects, informal communications can be held over chatting or calls between team members with the same purposes as in-house development.

Motivation: As we discussed earlier, if team members do not socialize enough with each other, trust can hardly be established between them. Any kind of informal communication may fill the lack of socialization in GSD.

Recommendation 13: “Use written communication (i.e. emails, documents, chat) in order to reduce the misunderstandings due to different language backgrounds.”

Explanation: Written communication is used in industry to reduce or avoid language misunderstandings. It is also very helpful in exchanging the technical information between remote sites. A following up call can be held to ensure the shared understanding.

Motivation: Misunderstandings due to poor language background may cause huge problems between remote team members. However, utilizing written communications can alleviate its negative impacts for trust building purposes. Further, lack of language skills may force team members to avoid socializations which also affects trust establishment negatively.

Recommendation 14: “Collect regular status report from each team member in order to track the progress of the project, evaluate the performance of individuals and minimize the risk of latency.”

Explanation: By collecting regular status reports, project manager is able to track the progress. Therefore, any issue can be identified early and by applying proper actions, projects can meet the deadlines.

Motivation: By collecting regular status reports from remote team members, project manager does not need to monitor them all the time. In addition, these reports may help him to discover team members’ capabilities and can build cognitive based trust.

Recommendation 15: “Evaluate work partner organizations and individuals before starting the actual work.”
Explanation: If possible, GSD organizations should evaluate their partners before starting the actual work. It decreases unpredictability of quality of final deliverables.

Motivation: Early evaluation is crucial for any kind of collaboration. It should be more focused in GSD since there is no possibility to walk around and observe what is going on and face to face communications are limited. So, early evaluation provides cognitive based trust for remote partners.

Recommendation 16: “Evaluate the individuals based on the requirements needed for the position i.e. communication skills for the managers, expertise for the developers, and language skills for people involved in joint communications.”

Explanation: Evaluating individuals before assigning tasks to them is helpful to put proper person in proper place. Hence, the overall performance of team is higher. People are more satisfied with their work. Hence, they can be more motivated to participate actively in communications.

Motivation: This practice addresses lack of language skills and cognitive based trust in GSD which are caused of lacking trust.

Recommendation 17: “Keep cooperation with the previous successful partners as much as possible in order to reduce the risks in the project’s success.”

Explanation: If a previous partnership was successful, it is suggested to maintain it. It does not include overhead of evaluating them one more time. Further, trust is already built and cooperation can be easier.

Motivation: This practice addresses lack of cognitive based trust which is crucial in building trust at the beginning of cooperation. With previous successful partners cognitive based trust is already built. However, affective based trust could also be established.

4.2.1.3 Maintaining Trust

Recommendation 18: “Discuss problems, issues, and updates immediately or with minimum delay via verbal communication channels such as phone calls or conference calls.”

Explanation: Any problem or issues should be discussed immediately, therefore we recommend project managers to use verbal channels to communicate. Issues and conflicts should be handled as early as possible between remote colleagues since lack of face to face meetings can increase the severity level of conflict.

Motivation: Lack of conflict handling is reported as a cause of losing trust in distributed cooperation. Therefore, it is important to make use of this practice to manage conflicts before they influence project’s success.

Recommendation 19: “Make an organizational culture of sharing problems with colleagues honestly.”

Explanation: Issues must be shared with the remote team honestly. It helps managers to take proper correction actions early and keep the deadlines and promises. Therefore, we recommend the authorized managers in organizations to make this attitude as an organizational culture and plan for it.

Motivation: Sharing problems honestly with remote colleagues is an answer to lack of conflict handling in GSD that leads to losing trust.

Recommendation 20: “Make the communications traceable by keeping the history in order to avoid misunderstandings by offline reviewing the history.”
**Explanation:** By making communications traceable, it is easier to manage the issues and resolve the conflicts. In addition, each person is able to trace the history and prevent the same issues from happening in future.

**Motivation:** Traceable communications help solving conflicts if they happen. Conflicts in GSD should be taken care of as early as possible due to lack of face to face meetings.

**Recommendation 21:** “In joint tasks, make use of same work processes, shared templates and standards in order to unify the work practices.”

**Explanation:** Using same processes in joint tasks is very important since it reduces the problems which occur in integration phase. It also reduces the misunderstandings. Furthermore, it can minimize the delays in the project since it helps reducing problems in the development and integration phases. It can increase the understandability between remote sites as well. Therefore, all remote team members are able to understand each other’s work easier and with minimum difficulties.

**Motivation:** Inconsistent work practices in GSD might cause losing of trust as a result of unsuccessful project. Therefore, it is crucial to use same work practices to increase understandability among teams.

**Recommendation 22:** “Share the significant benefits of the project with all individuals involved in the project.”

**Explanation:** By sharing the benefits of the project with all involved people, they may trust the organization more and assume that as their own. They might be more motivated in future projects to deliver the better results.

**Motivation:** As it was elaborated earlier, fear of losing job is a hindrance on trust establishment which has to be taken care of by project managers as well as competitive reward system. Encouraging team members to share best practices freely with each other, increases the teamness feeling among them by which they help each other for success and trust easier and avoid competing with each other if reward system is fair.

**Recommendation 23:** “Modularize work packages, and define interfaces for each module in order to reduce dependencies.”

**Explanation:** One practical solution for minimizing the dependencies in GSD is to break down the project into different modules and then define interface for each. Hence, remote teams do not need to wait for each other’s work accomplishment. In addition, each module can be tested independently and in integration phase, tracing the bugs is easier.

**Motivation:** This practice is highly recommended to reduce the task dependencies between distributed sites. High task dependencies can indirectly lead to losing trust since they make overhead and rework.

**Recommendation 24:** “Manage source code by utilizing versioning control tools such as Perforce or Clear Case.”

**Explanation:** When development part is shared between remote offices, it is very important that changes on source code are logged and accessibility is controlled. By using tools for this purpose, it is possible to see the updates immediately and avoid rework.

**Motivation:** Source code management is recommended in order to handle dependencies between remote teams.

**Recommendation 25:** “Encourage sharing of best practices among distributed teams.”

**Explanation:** If team members share best practices among them, their performance can improve. It indirectly can improve the trust building and establishment between them. If a
practice has worked well for a site, it might also work for the remote one. Hence, collaborating sites should share their best practices.

**Motivation:** Fear of losing job is a hindrance on trust establishment which has to be taken care of by project managers as well as competitive reward system. Encouraging team members to share best practices freely with each other, increases the teamness feeling among them by which they help each other for success and trust easier and avoid competing with each other if reward system is fair.

**Recommendation 26:** “Cooperate closely in case of high dependency or happening of a severe issue in a project i.e. by staff exchange.”

**Explanation:** One practice in case of occurring severe issues can be exchanging team members or travelling between sites. Project managers should evaluate the project continuously and be prepared for potential problems. Further, the practices to address potential risks should be identified early in the plans.

**Motivation:** This practice is recommended in order to handle conflicts and task dependencies in GSD. Conflict management is essential in GSD since lack of that can cause a failure and destroy trust. Dependencies of tasks should also be managed to avoid negative effects on project’s success and trust maintenance between team members.

**Recommendation 27:** “Utilize proper project management tools such as MS project, Bug Tracker, Bugzilla, MS Excel, MS Power Point in planning, scheduling, controlling, monitoring and coordinating the project.”

**Explanation:** Project management tools are helpful in all software development projects. Their role in GSD projects was also emphasized in conducted interviews.

**Motivation:** Utilizing proper tools can help manager to control the project indirectly instead of monitoring team members too often. Further, dependencies of tasks can be managed to avoid negative effects on project’s success and trust maintenance between team members.

4.2.1.4 Building and Maintaining Trust

**Recommendation 28:** “Plan the communications in advance including media, contacts, timelines, rules and regulations.”

**Explanation:** This practice makes the communication predictable for each cooperating site. Each party should be aware of communication mechanism, tools, contact persons, timelines, and rules and policies early in the project.

**Motivation:** A serious cause of both lacking and losing trust in GSD is unpredictable communication. It hinders trust building at the beginning. However, if trust is already established, unpredictability in communications might lead to reduce or lose it completely. Hence, predictability in communications is essential for trust establishment and sustaining in GSD that can partly be achieved by planning the communications in advance.

**Recommendation 29:** “Build a central information pool including knowledge, list of contacts and competences for each team member which is accessible for all individuals involved in the project.”

**Explanation:** Each team member can share the best practices and their knowledge in the central information pool and trace the updates of the project. It covers the lack of informal communication to a great extent.

**Motivation:** This practice addresses both trust building and maintenance challenges. Distance in GSD is an obstacle in trust establishment. However, if team members are afraid
of losing their job due to use of remote team trust can hardly be built among them. Another factor which prevents trust building in GSD is lack of socialization. Further, if team members feel too much monitoring and control from their manager, they might lose their trust. Competitive reward system is another reason of losing trust in which team members become each other’s rival instead of helping each other to achieve the shared goal. Therefore, it is highly recommended to establish a central information pool in which all team members can exchange information freely which can be a replacement of socialization among them. They can access the information pool anytime and check the updates with no time zone limitations. It encourages team members not to have fear of losing their jobs as well when everything is easy to access for all members.

A project manager does not need to check his team directly and frequently while he can check the central pool and trace the progress and information exchange as often as needed. When information is freely shared between teams, they will have more feeling of working in the same team and helping each other, hence they do not feel like competing closely with each other.

**Recommendation 30:** “Encourage use of instant messages tools such as IRC chat, MSN, and Skype among distributed team members continuously during the working hours.”

**Explanation:** IM tools make remote team members available for each other during the overlapping working hours. They can share knowledge, discuss issues and at the same time socialize informally.

**Motivation:** This practice alleviates lack of face to face meetings in GSD as a cause of lacking trust by providing possibility for remote team members to chat to each other regularly as often as needed. However, it is applicable on offices which have overlapping working hours. It is also helpful in case of lack of language skills as a cause of lacking trust because it is a written communication which lets users to think and find proper words for communications. Further, reduction in communications may lead to losing of trust among remote colleagues which can be addresses by using chat tools.

**Recommendation 31:** “Exchange team members on collaborating locations in order to reduce the communication overhead and minimize the risk of task dependencies.”

**Explanation:** In high dependent tasks, it is highly recommended to exchange team members and collect them in the same or close places. However, in any kind of remote collaboration it is recommended to exchange team members. There should be possibilities for team members to travel between sites if needed.

**Motivation:** The best practice to address lack of face to face meetings is surely exchanging remote team members. It also can enrich the socialization since they work in the same office together. Furthermore, it also addresses the reduction in communication as a cause of losing trust. Finally, it is a practice addressing distances in GSD which is a cause of both lacking and losing trust.

**Recommendation 32:** “Gain cultural awareness either by experience or training to understand each other values and differences.”

**Explanation:** By understanding each other’s culture in GSD collaborations, it is easier to understand the differences in working styles or response to issues. It assists project managers in planning and controlling the project. Furthermore, it reduces the misunderstandings due to different cultural backgrounds.
Motivation: Poor socio-cultural fit in GSD collaborations is a cause of lacking and losing trust. Hence, before and during cooperation with remote sites, it is crucial to gain information on cultural differences. When a manager is aware of his remote team’s culture, he can plan the project better. Further, misunderstandings between team members or manager can decrease due to awareness.

Recommendation 33: “Minimize delays in communications by utilizing both synchronous communications methods and distributing correlated tasks among near time zone areas.”
Explanation: Delays in communication can be due to large time zone differences or using the asynchronous methods. Hence, it is recommended to spread the dependent tasks among near time zone offices if possible. However, synchronous channels such as phone calls or chats are recommended to communicate in case of urgent need for information exchange or discussing an issue or brainstorming.
Motivation: Delays in communications are causes of both lacking and losing trust. Thus, it is important to minimize them in GSD. They might cause misunderstandings between remote colleagues.

Recommendation 34: “Apply Agile practices to benefit from its short iterations, early feedbacks, and communication encouragement.”
Explanation: Agile encourages communication, has short iterations, and feedbacks early. Therefore, it is suggested as a powerful practice to use in GSD. Project managers are able to identify potential problems early in projects by utilizing Agile practices and make correction actions if necessary. All involved sites in GSD projects need to use it and feedback on progress regularly in short iterations.
Motivation: Utilizing Agile practices can alleviate lack of face to face meetings and cognitive based trust in GSD. They both hinder building trust and Agile with communication encouragement and short iterations provides facilities to alleviate their negative effects. Further, communications are predictable by using Agile which a trust maintenance activity. It provides consistent work practices among distributed teams and improves the quality of the result. In addition, it reduces the need for close monitoring and control of remote teams since in regular meetings they become aware of each other’s progress and capabilities.

Recommendation 35: “Stay available as much as possible to cover different time zones and reduce the delay in communications.”
Explanation: It is critical for project managers to be available for their remote team members as much as possible. It can be achieved by using informal communication channels.
Motivation: Delays in communications are causes of both lacking and losing trust. Thus, it is important to minimize them in GSD. They might cause misunderstandings between remote colleagues. Being available for each other in a GSD project will improve trust among team members and they put more effort in return for the success of the project.

4.2.2 Software Development

Recommendation 36: “Clarify the roles and responsibilities in a meeting or documents for all people involved.”
Explanation: By clarifying all roles and responsibilities, a project manager is able to get every team member’s buy-in early in the project.

Recommendation 37: “Make mutual expectations very clear in an agreement.”
**Explanation:** If each party is aware of the other one’s expectations, the final deliverables will have higher quality based on the initial requirements. However, this practice can indirectly increase the performance of team in the absence of ambiguities and misunderstandings. Hence, rework is not needed and the team is also more satisfied. And finally, the risk of latency is minimized.

**Recommendation 38:** “Reduce staff replacement in teams in order to keep the teamness.”

**Explanation:** When a team is formed and team members are working properly, trust is already established. Therefore, team members should not be replaced or exchanged if possible. When they have already worked with each other, they help each other more and discuss issues more openly, hence the performance of team is higher.

**Recommendation 39:** “Assign tasks on team members based on their performance and technical capability.”

**Explanation:** Project managers should evaluate team members’ performance and capabilities. Therefore, they are able to assign proper tasks and roles to them. As a consequence, their performance is higher and the quality of the result is not unknown.

**Recommendation 40:** “Analyze finished projects in the form of lessons learned, post mortem, or final reports to improve the quality and reduce development time and costs.”

**Explanation:** It is crucial for project managers to analyze finished projects in order to learn from the past and apply it for future. It enables them to avoid same mistakes in future, and also make better estimations on time and budget.

**Recommendation 41:** “Make quality plans in advance in order to clarify the quality expectations.”

**Explanation:** It is important to understand each other’s expectations in GSD projects. Hence, we recommend project managers to make quality plans in advance and share them with remote team to avoid later misunderstandings or misinterpretations.

**Recommendation 42:** “Prioritize concurrent projects and tasks in order to track dependencies and to meet deadlines.”

**Explanation:** If team is involved in more than one project at the same time, an effective strategy to keep the deadlines and handle the dependencies is to prioritize the tasks.

**Recommendation 43:** “Perform regular performance evaluation in order to track the schedule and evaluate the current status of the project.”

**Explanation:** By evaluating the performance of team regularly, project managers are able to gain the realistic capabilities of the individuals and therefore they have the information on realistic status of the project as well.

**Recommendation 44:** “Utilize proper tools such as MS Excel and MS Power Point to make your message understood.”

**Explanation:** Project managers should use auxiliary tools to make their message understood for their local or remote team. It is crucial to ensure that they have received the message as it was expected.

**Recommendation 45:** “Train and evaluate new comers to the team regarding the required competence and communication requirements in order to prevent unpredictability of quality in results.”
**Explanation:** New comers should be trained based on the requirements of the project in order to ensure the achievement of the expected quality and meeting the deadlines.

### 4.3 Discussions

All recommendations are mapped to the participating organizations in Figure 7 and Figure 8. The row numbers show the organizations’ number which were mentioned before in Figure 2 and the column numbers indicate the recommendation’s number presented in section 4.2. In addition, all identified threats are listed in Figure 9 and identified industrial practices are mapped to them. For each cause, a list of relevant recommendation numbers and total number of recommendations is given.

**Table 1:**

<table>
<thead>
<tr>
<th>Organization</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X X X X X</td>
</tr>
<tr>
<td>2</td>
<td>X X</td>
</tr>
<tr>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>X X X</td>
</tr>
<tr>
<td>5</td>
<td>X X</td>
</tr>
<tr>
<td>6</td>
<td>X X</td>
</tr>
</tbody>
</table>

**Figure 7 – map between organizations and recommendations 1..25**

**Table 2:**

<table>
<thead>
<tr>
<th>Organization</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X X X</td>
</tr>
<tr>
<td>2</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>X X</td>
</tr>
<tr>
<td>5</td>
<td>X X</td>
</tr>
<tr>
<td>6</td>
<td>X</td>
</tr>
</tbody>
</table>

**Figure 8 - map between organizations and recommendations 26..45**

Further, all recommendations are categorized based on their relevance to SD, GSD, and trust in Figure 12. It also shows how recommendations are related to building or maintaining trust directly or indirectly.

When talking about cultural differences and trust related concerns, the importance of awareness is highlighted. This awareness of cultural differences can be gained by experience of working with different cultures. Therefore, we can conclude that assigning GSD management roles to the experienced project managers who are aware of GSD related issues with good extent of communication skills has the significant effect on the success of the GSD projects.

We would like to emphasize that it is also very critical for GSD organizations to establish the culture of experience sharing among project managers to benefit from each other’s experience. Moreover, we observed that only utilizing one communication channel does not facilitate effective communication between distributed team members and combination of methods is appreciated by project managers in order to address different needs in communications.
### Table

<table>
<thead>
<tr>
<th>Threat</th>
<th>Recommendation No.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>unpredictable quality of result</td>
<td>1, 8, 14, 15, 16, 17, 34, 37, 39, 40, 41, 43, 45</td>
<td>13</td>
</tr>
<tr>
<td>unrealistic time estimation</td>
<td>7, 14, 15, 28, 32, 34, 40, 42, 43</td>
<td>9</td>
</tr>
<tr>
<td>complexity of the project</td>
<td>1, 3, 7, 17, 27, 32, 34, 42, 43</td>
<td>9</td>
</tr>
<tr>
<td>poor performance</td>
<td>15, 16, 17, 25, 37, 39, 40, 41</td>
<td>8</td>
</tr>
<tr>
<td>latency in task accomplishment</td>
<td>1, 3, 14, 26, 34, 37, 42</td>
<td>7</td>
</tr>
<tr>
<td>lack of teamness</td>
<td>1, 9, 17, 29, 31, 35, 38</td>
<td>7</td>
</tr>
<tr>
<td>unrealistic budget estimation</td>
<td>3, 6, 7, 15, 32, 34, 40</td>
<td>7</td>
</tr>
<tr>
<td>unrealistic progress evaluation</td>
<td>3, 14, 18, 19, 27, 34, 43</td>
<td>7</td>
</tr>
<tr>
<td>lack of cognitive-based trust</td>
<td>14, 15, 16, 17, 34</td>
<td>5</td>
</tr>
<tr>
<td>complexity of task distribution</td>
<td>3, 4, 27, 32, 34</td>
<td>5</td>
</tr>
<tr>
<td>lack of face to face meeting</td>
<td>10, 11, 30, 31, 34</td>
<td>5</td>
</tr>
<tr>
<td>Distances</td>
<td>29, 31, 33, 35</td>
<td>4</td>
</tr>
<tr>
<td>increased monitoring and control</td>
<td>14, 27, 29, 34</td>
<td>4</td>
</tr>
<tr>
<td>task dependencies</td>
<td>23, 24, 26, 27</td>
<td>4</td>
</tr>
<tr>
<td>lack of informal communication</td>
<td>12, 29, 30, 31</td>
<td>4</td>
</tr>
<tr>
<td>lack of conflict handling</td>
<td>18, 19, 20, 26</td>
<td>4</td>
</tr>
<tr>
<td>poor socialization</td>
<td>9, 12, 29, 31</td>
<td>4</td>
</tr>
<tr>
<td>delay in response</td>
<td>2, 18, 30, 33</td>
<td>4</td>
</tr>
<tr>
<td>communication overhead</td>
<td>4, 17, 43, 44</td>
<td>4</td>
</tr>
<tr>
<td>integration problems</td>
<td>21, 23, 24</td>
<td>3</td>
</tr>
<tr>
<td>fear of losing job</td>
<td>22, 25, 29</td>
<td>3</td>
</tr>
<tr>
<td>lack of language skills</td>
<td>13, 16, 30</td>
<td>3</td>
</tr>
<tr>
<td>competitive reward system</td>
<td>22, 25, 29</td>
<td>3</td>
</tr>
<tr>
<td>reduction of communication</td>
<td>30, 31</td>
<td>2</td>
</tr>
<tr>
<td>reduced synchronous communication</td>
<td>30, 35</td>
<td>2</td>
</tr>
<tr>
<td>unpredictable communication</td>
<td>28, 34</td>
<td>2</td>
</tr>
<tr>
<td>inconsistent work practices</td>
<td>21, 34</td>
<td>2</td>
</tr>
<tr>
<td>late defect introduction</td>
<td>23, 24</td>
<td>2</td>
</tr>
<tr>
<td>socio-cultural fit</td>
<td>32</td>
<td>1</td>
</tr>
<tr>
<td>poor communication infrastructure</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 9 - map between threats and recommendations

However, the most surprising answer in interviews was “cost reduction” as a consideration in team building and achieving time and cost goals as success criteria for each project.

Figure 10 – number of recommendations in different categories
It is also recommended that organizations provide expertise and infrastructure to tailor the processes, standards, tools, and knowledge based on their needs and requirements.

One of the most interesting findings from the interviews was that all participants stated the importance of the availability of team members for each others. One organization coped with this matter by assigning roles and defining a contact list which is later available to everyone involved in the project. Another organization solved it by demanding from their team members to always be available on chat by setting it as an organization policy. Both organizations stated that their developers were regularly communicating and even developing informal relationships.

<table>
<thead>
<tr>
<th>Recommendation No.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>27</td>
</tr>
<tr>
<td>Trust</td>
<td>13</td>
</tr>
<tr>
<td>Build</td>
<td>4</td>
</tr>
<tr>
<td>Maintain</td>
<td>7</td>
</tr>
<tr>
<td>Build &amp; Maintain</td>
<td>2</td>
</tr>
<tr>
<td>General</td>
<td>14</td>
</tr>
<tr>
<td>GSD</td>
<td>18</td>
</tr>
<tr>
<td>Trust</td>
<td>14</td>
</tr>
<tr>
<td>Build</td>
<td>5</td>
</tr>
<tr>
<td>Maintain</td>
<td>3</td>
</tr>
<tr>
<td>Build &amp; Maintain</td>
<td>6</td>
</tr>
<tr>
<td>General</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 11 – map between recommendations and categories

This long list of recommendations has pointed out one important concern. There are many different practices applied in GSD teams worldwide to address trust related issues. At the same time, the research has not provided any detailed insight on the matter, nor has it been trying to analyze problems and propose solutions in a satisfactory grade. This is not very surprising considering a fact that industrial representatives have not been enough aware of importance of trust, but are more focused on other consequences of distances in GSD. In our findings, once trust is lost it cannot be re-established. This is an indicator that trust issues should be taken seriously, and how important it is to build trust awareness in GSD involved industry.

It is also important to mention that the resulting list of practices is a collection from different types of GSD organizations, with different domains, size and scope. It is created in such way with the purpose of covering wide range of different organizational settings. It is very important to be aware of this fact while considering the applicability of each of the recommendations. Every of the mentioned one comes from a particular setting in industry, which might make it not applicable in radically different setting type. For example, the following recommendation Plan and keep a regular face to face meeting with the remote team might not be applicable for small organizations or those ones which have their remote team too far away. It is therefore important, and up to a manager, to evaluate every of the recommendations before applying it.
Using instant message tools for chatting during the working hours has shown good results in the majority of participating organizations of this study. In addition, combining chatting with an early face to face meeting can be considered as a powerful approach to alleviate the lack of face to face meetings in GSD projects. Another study confirms the results of our study [91].

<table>
<thead>
<tr>
<th>Recommendation No.</th>
<th>Directly Related to</th>
<th>Applicable to Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trust GSD SD Build Maintain</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>2</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>3</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>4</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>5</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>6</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>7</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>8</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>9</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>10</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>11</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>12</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>13</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>14</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>15</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>16</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>17</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>18</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>19</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>20</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>21</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>22</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>23</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>24</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>25</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>26</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>27</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>28</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>29</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>30</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>31</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>32</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>33</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>34</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>35</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>36</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>37</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>38</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>39</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>40</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>41</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>42</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>43</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>44</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>45</td>
<td>X</td>
<td>√</td>
</tr>
</tbody>
</table>

Figure 12 – categorizing of recommendations
Further, the recommendations are classified in the Figure 12 for clarifying their relation to different contexts. This classification will help the reader to gain a clearer view of the applicability of every proposed recommendation. It also shows if a recommendation is related to trust, GSD or software development (SD) in general. Moreover, the same figure shows if a recommendation is related to trust building, maintaining or both.

The overall picture of recommendations is given in Figure 10 to show their overlapping areas and present the number of recommendations for each category. For extracting the final list, practices which were directly or indirectly mentioned in SD literature [92][93] were considered as SD recommendations and those which could not found in SD literature as GSD. The same method applied on trust building and maintenance practices in SD to distinguish the ones which are specifically applicable in GSD. At the end, Figure 11 lists the recommendation numbers for each category in order to highlight the recommendation’s place of applicability.

Finally, it should be noted one more time that all recommendations were extracted from industrial interviews focusing on trust issues in GSD. Later, they were categorized in that basis which is presented in Figure 12. However, another approach for classifying the suggested recommendations was to compare them with the general software development literature and mark similar practices as SD practice rather than GSD. Therefore, some recommendations belong to both SD and GSD in new categorization which is clarified in Figure 10 and Figure 11. They show the number of recommendations for each category and picture their overlap parts visually.

4.4 Validity Threats

Validity threats must be handled for every study to identify all key factors which can affect the accuracy or dependability of the results. Although Wohlin has categorized validity threats in four types named external, construct, internal, and conclusion validity [89], other literature address them differently for example in [61], they are identified as internal, external, construct, and statistical threats.

This section will discuss threats to internal and external validity, which are relevant for this type of qualitative study. Activities for minimizing and avoiding negative impacts of each threat were performed by the researchers, as reflected in the following subsections. In external validity we focus on the generalizability of findings to other settings and contexts.

4.4.1 Internal Validity

As described in section 1, our study was exploratory. Hence, it is not specifically looking for causal relationships with respect to the study constructs. Internal validity is to what extent the findings of a study precisely represent a causal relationship between an independent variable(s) and the dependent variable (or outcome) [61][62]. Internal validity is also defined as the relationship of causes and effects or causal relationship in [89]. Thus, internal validity is to ensure that collected data enables the researchers to draw valid conclusions.

The transcript of each interview was prepared immediately after the interview meeting that reduced the risk of forgetting some part of unwritten information. Furthermore, the transcription document was sent back to the interviewee to confirm the content.

All interviews were prepared and conducted in English except two where questions were asked in English but answers obtained in other languages. We do not see that as a threat since refined transcripts were sent back for approval in English and potential loss in translation is being prevented in this way.
4.4.1.1 Qualitative Validity Threats

A validation technique called triangulation is used in qualitative studies to ensure the validity of the research [47]. Triangulation is a method that compares three or more types of independent perspectives on a given aspect of the research process (methodology, data, etc.) in order to improve the accuracy of findings [47]. Different types of triangulation can be used together to form a strong basis of validity. The triangulations used in this study were: data, methodological, and investigator triangulations.

**Data Triangulation:** Data triangulation is the use of different sources of data/information on which the study results are based. If there is consistency in the data/information provided across the various data sources that are used, then this suggests that the data is valid. In this study, data-set came from managers in the form of interviews. The initial plan was to interview two managers in each participating organization in order to compare their answers in data analysis and omit the very personal judgments when deriving conclusions. However, due to the organizations limitations, it was not possible in all cases and data was collected from one manager’s point of view.

Moreover, the interview is designed in such way that the questions are not related directly to trust issues. We have noticed that there is a high probability for causing confusion by asking questions that are directly related to trust, trust building or maintaining. We have noticed this from a small sample of participants who were asked these kinds of questions.

**Methodological Triangulation:** Methodological triangulation uses different methodological techniques that could be quantitative or qualitative in the study [47]. If the conclusions from each method are consistent, then the validity of the results is increased [47]. We used qualitative method both as deep literature review and semi-structured interviews. Further, the observations of one of the authors who have worked in a software company involved in GSD for more than four years were also used in both design and conduct of the study to help the validity of research.

**Investigator Triangulation:** Investigator triangulation is to use several investigators/researchers in the conduct of the research and all processes [47]. In each stage in the process such as data collection, data analysis, and research question validation we were two researchers that performed and validated the processes. The findings from each researcher were reviewed by the other one and comparison is made to ensure that their conclusions were similar. Therefore, investigator triangulation is also reached in our study. It should be noted that this study had two supervisors who reviewed the work in all steps which in consequence improved the validity of the findings.

Ecological validity threat has been considered from the beginning of this study. As a consequence, a wide range of different organizational settings was accepted for participation. This includes, for example, both off-shoring and outsourcing, small medium or large organizations, with virtual, globally or non-globally distributed teams. There is little reason to believe that the results could not be generalized in different contexts since it covers broad range of software companies.

4.4.2 External Validity

External validity is to what extent findings from the study can be generalized to and across populations of persons, settings, and time [62].

**Population Validity:** We have used different companies with different type of software products to cover broader range of organizations. Moreover, we have studied organizations in Asia, Africa, and Europe to increase cultural diversity in our data collection. The Asian company works for a company in USA and European companies work with offices in Africa, Asia, USA, and Europe which includes a number of different cultures and geographically distributed places in our study and enriches the quality of data collection. It should also be mentioned that in this study, different point of views have been covered since participants were both supplier and customer. For example Flextronics and Ericsson are both involved in customer-supplier relationships with each other or with other companies.
**Temporal Validity**: There is not much reason to believe that the results can be generalized over time. Technology is evolving and new tools will be introduced both for managers and developers. We cannot ensure the generalizability of the results over time.
5 CONCLUSIONS

Trust among globally distributed team members was studied in this thesis. We were mainly concerned with how to build and maintain it during the project development. The research was designed as exploratory in nature. First part of the research includes literature study and review with the purpose of identifying causes of lacking and losing trust as well as practices to overcome these causes. The second part collected practices applied in GSD industry through conducting semi-structured interviews with managers. Finally, grounded theory was applied in order to analyze the whole set of data and conclude the research.

The results of the research highlighted the role of managerial actions in success or failure of every trust related practice. However, the most challenging area was found to be communication. The organizational settings and structure determines the applicability of the set of recommendations proposed by this study. Moreover, significant differences between out-sourcing, off-shoring, and virtual team collaborations are identified which lead to applying different practices for each. It should be mentioned that the exploratory nature of this study - led to collection of industrial experience which was one of the most challenging phase. However, it provided good basis for future research regarding trust building and maintenance issues or success factors.

5.1 Answers to the Research Questions

In this section we map the results of the research to the research questions to verify its completeness. Based on the outcome of this study, each question and the possible answer to address that is explained in the following.

Q1: What are the main causes of lacking trust among globally distributed teams?
Section 2.4.1 presented the causes extracted from literature which are reported to be: poor socialization, socio-cultural fit, unpredictable communication, lack of face to face meeting, reduction of communication, lack of language skills, inconsistent work practices, increased monitoring and control, lack of conflict handling, lack of cognitive based-trust, fear of losing job, high task dependency, competitive reward system, and distances.

Q2: What are the main causes of losing trust?
Section 2.4.1 explained them in detail. The answer of the previous research question has listed them down.

Q3: What practices for building/maintaining trust have been reported in the existing literature?
The result of careful analysis of existing literature to find current practices of building and maintaining trust presented few practices which are mentioned in literature review in section 2.

Q4: Which practices have been successfully applied in industry to overcome the trust building difficulties or to prevent from losing trust?
To answer this question, comprehensive literature review and semi-structured interviews were conducted. Section 4.2 explained the industrial practices in more detail.

Q5: Is there any action, or combination of actions, that can serve as a substitute for building/maintaining trust through face-to-face communication?
As a substitute for face to face communication in distributed software development, the use of instant message tools for chatting during the working hours has shown good results in the majority of participating organizations of this study. Combining chatting with an early face to face meeting can be considered as a powerful approach to alleviate the lack of face to face meetings in GSD projects.
5.2 Personal Observations

During our study we were able to observe a couple of interesting phenomena. It is not in our study scope to put our focus on them; however we think that they might be important for future research.

First of all, we noticed that participating managers were interpreting some of our questions in a slightly different way. Swedish managers were interpreting in a way similar to other Swedish managers. The ones from Malaysia, which are Iranians by origin were also interpreting differently, but still similar to each other. Both Serbian and South African managers differed from the other ones. Moreover, the answers also slightly differed among managers from different cultures. It seemed for us that this is a potentially cultural issue that might be a starting point for future research.

Second important observation is about expectations that participating companies have about our studies. All of them are very interested to see our results, despite their large experience on the matter. This was an additional confirmation for us that trust related area is still not enough researched, despite the large interest from industry.

Finally, we could observe one phenomenon that was quite surprising for us. Namely, we have constructed questionnaire for developers as a part of our study. The goal was to extract the same type of data from developers as we did from managers. Unfortunately, we were forced to abandon the idea due to low amount of responses. However, there are three interesting responses, two from a company in Serbia (not same as the one in our study) and one from their remote team in Austria. It could be seen from these responses that their most preferred and used channel of communication is chatting. It is the same finding as for the team in Troxo, Serbia. We notice that this is a very interesting practice, and it is only applied in mentioned teams in Serbia and their respective remote teams in Austria and Sweden. This practice has been employed years ago and proven to give good results. We argue that this practice has been successfully replacing regular face to face meetings, since everybody is available for everybody through a synchronous written communication.

5.3 Future Work

By exploring the little known area of trust building and maintaining in GSD environments, this study has widely opened the door for future research in the field. The exploratory study has revealed a number of practices, where any of them can be a potential candidate for future research. An example could be to study if availability of every team member on IRC chat during working hours can increase informal communication and strengthen interpersonal relationships.

Moreover, the four identified management areas namely coordination, control, communication, and planning can also be a subject of research. Contribution can be made by for example studying the relationships between threats and practices in communication, coordination, planning or control.

Generalization of our results was not in the scope of the study, but can be considered as a good basis for a future one. It would also be interesting, in our opinion, to find out how would different organizational settings affect the selection of trust building/maintaining practices.

Finally, maybe one of the biggest opportunities for future research is to study developers’ opinions on the same matter as our study did from the managers’ perspective. This would contribute not just in the way that opinions of developers become known but also to be able to see in what grade developers are aware of trust related issues in GSD environments compared to their managers. Since there are many possibilities for future contributions, we consider that we fulfilled the purpose of exploratory study.
6 REFERENCES


[22] M. Vanzin; M. B. Ribeiro; R. Príkladnicki; I. Ceccato; D. Antunes (2005); “Global Software Processes Definition in a Distributed Environment”, United States: Institute of Electrical and Electronics Engineers Computer Society: Greenbelt, MD, Piscataway, NJ; 08855–1331.


[26] H. K. Edwards; V. Sridhar (2003); “Analysis of the effectiveness of global virtual teams in software engineering projects”.


[40] E. Carmel (1999); “Global Software Teams Collaborating Across Borders and Time Zones”, Prentice Hall.


[47] L. Guion (2002); Triangulation: establishing the validity of qualitative studies, University of Florida Extension: Institute of Food and Agricultural Sciences.


[54] F. J. F. Flower; M. P. Couper; J. M. Lepkowski; E. Singer; R. Tourangeau (2004); Survey Methodology, Edited by R. M. Groves, John Wiley & Sons Inc.


[63] D. Damian (2002); “Workshop on Global Software Development”, Proceedings of International Conference on Software Engineering (ICSE), USA.

[64] D. Šmite; N. B. Moe; R. Torkar (2008); “Pitfalls in Remote Team Coordination: Lessons Learned from a Case Study”, Accepted for presentation and publication in PROFES 2008 int. conf. proceedings, Italy.


[76] L. Kiel (2003); “Experiences in Distributed Development: A Case Study”, Proc. ICSE International Workshop on Global Software Development, USA.


[78] T. Zimmer (1972); The impact of Watergate on the public’s trust in people and confidence in the mass media, Social Science Quarterly 59, pp. 743-751.


[93] IEEE (2004); Guide to the Software Engineering Body of Knowledge (SWEBOK), IEEE Computer Society, Angela Burgess, USA.
APPENDIX A: INTERVIEW QUESTIONS

Introductory Questions
1. For how long have you been in a management position?
2. For how long have you been involved in GSD?
3. Brief history of the company
4. Introduction of the current product

Domain Specific Questions
1. Is communication between the local and remote teams planned or it happens randomly when it’s needed?
   a. How is your team introduced to the remote one?
   b. How do teams know their roles and responsibilities? When?
2. Which communication methods do you use mostly? Why? Which one is preferred?
3. How does the local team socialize with the remote one?
   a. Encouragement for special channels? Why?
   b. Formal/informal channels
   c. Do they meet? How often?
   d. Staff exchange? Ambassador?
   e. To what extent, two teams are aware of each other’s competence?
4. How helpful do you find your tools in planning/controlling/monitoring the project? Which tools?
5. How do you keep track of the progress of the remote team’s project? How do you report your own progress to them?
6. How do you evaluate the performance of the remote team(s)? How often?
7. How tasks are distributed among the local and the remote teams?
8. To what extent, your local and remote teams’ work is dependent? How do you manage dependencies?
9. Do you use the same development processes as your remote team? Which processes? Why?
10. Do misunderstandings and/or conflicts happen due to cultural/language diversities?
    a. YES: Is there any mechanism to prevent and/or resolve them?
    b. NO: How did you prevent it from happening?
11. Does the team receive any training on effective communication with the remote colleagues?
12. What are the main considerations in building a team for global software development?
13. Are you involved in more than one project at the same time? How do you plan and manage it?
14. What is being rewarded by your company? To whom rewards are granted?
15. How do you analyze finished projects to resolve communication-related issues in future?
16. Do standards/templates/conventions cause unnecessary overhead and delays? Do they reduce the disparities in your work? How do you apply standards/templates?
APPENDIX B: TABLE OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSD</td>
<td>Global Software Development</td>
</tr>
<tr>
<td>SD</td>
<td>Software Development</td>
</tr>
<tr>
<td>IM</td>
<td>Instant Message</td>
</tr>
<tr>
<td>GT</td>
<td>Grounded Theory</td>
</tr>
</tbody>
</table>