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Trust Dynamics in Global Software Engineering

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ABSTRACT

Trust is one of the key factors that determines success or failure of any software project. However, achieving and maintaining trust in distributed software projects, when team members are geographically, temporally and culturally distant from each other, is a remarkable challenge. This paper explores the dynamics of trust and best practices performed in software organizations to address trust-related issues in global software engineering. Semi-structured interviews were conducted in six different distributed software development organizations and a resulting trust dynamics model is presented. Based on the findings, the paper also provides suggestions for the industry to achieve trust in distributed collaborations.

Keywords

Trust, Trust Building, Trust Maintenance, Global Software Engineering.

1. INTRODUCTION

Distributed teams comprising stakeholders from different national and organizational cultures, different geographic locations and potentially different time zones characterize Global Software Engineering (GSE). These conditions have significant consequences on communication, coordination, and control [1]. Since software development depends on human interactions, addressing these challenges is critical for successful cross-border collaborations.

Mitigating the GSE challenges however, is not a straightforward task. While frequent face-to-face communication in co-located teams supports achieving trust and a feeling of “teamness” among the remote colleagues, distance and cost-saving strategies in GSE often do not allow team members to travel between sites and meet [31]. In addition, different organizations may mean differences in the software processes [3], organizational standards, organizational cultures and policies, which might add additional difficulties to build and maintain cohesion and trust for the collaborating teams.

Given these constraints, distributed teams must rely on each other and find ways of working that tie them together. Trust is considered as the glue that holds the dispersed teams together and has been identified as an indicator of success or failure of distributed projects [2][28]. When trust exists, it enables more open communication among team members, which increases their performance and quality of the products at the end [2]. Team members have predictable behavior and can therefore rely on each other to successfully accomplish the work [11].

Therefore, project managers have to seek strategies for addressing trust-related issues and engage distributed teams in the activities

directed towards building, maintaining and improving trust, which we call in this paper; trust achievement. Although the significance of trust in the context of international organizations that exploit distributed software team is very well understood [28], the dynamics of trust in distributed teams requires deeper investigation for bringing useful suggestions to the project managers for trust achievement as well [12]. Moreover, a recent systematic literature review on the evidence in GSE-related research literature [37] identified that the amount of empirical studies in GSE is relatively small.

This paper explores the trust in GSE collaborations based on a qualitative empirical study. First, a literature review was performed to investigate the trust dynamics and how trust is achieved in distributed teams. Then, interviews were conducted in six different software organizations in order to further explore the trust relationship throughout the project life cycle and to identify the best practices to build and maintain trust among distributed teams.

The paper is organized as follows: Section 2 provides the background for this study. Section 3 presents the details of the qualitative study we conducted and discusses the findings. Finally, conclusions and future research suggestions are presented in Section 4.

2. BACKGROUND

Trust is a multidimensional concept that can be explored at different levels such as within or among group(s), organization(s), or society [39]. It has been a topic of different disciplines such as philosophy, psychology, sociology, economics, and computer science [34]. Therefore, various trust definitions in different fields exist.

In this study, we consider the following definition: “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 the other party” [23]. This implies that in a trust relationship there are two parties (trustor and trustee), a trust object, and a trust environment [34]. Furthermore, Rousseau et al. [32] stated that trust is not a behavior or a choice, but a psychological state that can cause or result from such actions. Therefore, trust has been viewed as a property of the relationship between parties, not as a property of the individuals [36].

Two major components of trust are recognized: the logically assessed component of trust that is called cognitive-based trust [14], and the social component known as affective-based trust. Cognitive-based trust is related to the *rational* characteristics of the trustees including reliability [24], responsibility [8], integrity, and competence [23]. Affective-based trust is related to the

emotional and social skills of the trustees [4]. Building and maintaining trust in temporary work contexts depends more on the cognitive element of trust rather than the affective [25].

In globally distributed software projects, the main obstacles for trust achievement are reported as geographical, temporal, organizational, cultural and political differences [16][19], and distance [6].

Moe and Šmite [28] identified the reasons which result in lacking, injuring or losing trust as: poor socialization and socio-cultural fit, increased monitoring, inconsistent work practices, reduction of communication, unpredictable communication, lack of face-to-face meetings, conflict handling, lack of some of the characteristics required to have cognitive-based trust and poor language skills.

Casey and Richardson [7] highlighted the importance and impact of fear and its consequences on trust achievement. Huang and Trauth [17] reported the complexity of cultural understandings at different levels with respect to language issues, communication styles and work behaviors as trust achievement hindrances.

Lack of trust has severe impacts on performance of people, schedule, rework, and communications [28]. The major effects of lacking trust were identified to be the decrease in productivity, quality, information exchange and feedback, morale among the employees, and an increase in relationship conflicts. Therefore, trust is a prerequisite for the successful accomplishment of distributed software projects.

The following sub-section summarizes the current literature on the suggestions for trust achievement in GSE.

2.1 Suggestions for Trust Achievement

Although the majority of the suggestions in the literature do not directly address trust, they implicitly improve trust building, maintenance or both.

Building Trust. Milewski et al. [27] proposed a bridging technique, in which one “bridge” location facilitates the collaboration and coordination across other locations. Mikawa et al. [26] suggested that open recognition of cultural differences and intentional strengthening of social ties among team members is important in distributed software teams.

Brannen et al. [5] observed that bicultural people (who have deeply internalized more than one cultural profile) are helpful in intercultural collaboration, communication and trust building. Dual identity immigrant managers are also reported to be effective in collaboration and trust building [22].

Maintaining Trust. A simulation model for improvements in GSE and a sub-model for trust improvement are suggested in [35]. The model combines the system dynamics paradigm with the discrete-event paradigm.

In [33], a “Shared Project Context” model is explained to address the trust-related issues. And in [3], liaisons technique is proposed. The liaisons are engineers who moved to a remote office for a short period of time and their responsibility is to meet the developers, learn the system, help complete the requirements and specifications, and communicate this information back to the development staff at their home office.

Building and Maintaining Trust. Kanawattanachai and Yoo [20] examined the dynamic nature of trust and the differences between high- and low-performing virtual teams, whose members are spread in different locations and work remotely. After observing the changing patterns in cognitive- and affective-based trust over time (early, middle, and late stages of project), it was concluded that high-performing teams were better at developing and maintaining trust and virtual teams relied more on a cognitive than an affective element of trust.

The results of an empirical study on software outsourcing relationships [2] show that; cultural understanding, creditability, capabilities, pilot project performance, personal visits, and investment are important factors in building trust. For maintaining trust, in addition to these factors, communication, contract conformance, quality, timely delivery, development processes, managing expectations, personal relationships, and performance are reported as being significant factors.

In [14], the criticality of the three components of trust (ability, integrity, and benevolence) at each life cycle stage for a virtual team (i.e. team establishment, inception, organization, transition, and accomplishment of the task) were investigated. As a result, a set of action steps that shall be taken by the managers and the team leaders (such as how to choose team members or proper team building activities or to give support to team members) were mapped to each stage.

The literature shows an increasing number of studies, which have been conducted to understand trust achievement in GSE. However, the dynamics of trust and the industrial practices for establishing and maintaining trust in software organizations have not been deeply explored yet. In the following section, we discuss the results of a qualitative study we performed by conducting interviews in software organizations to investigate further trust-related practices and the dynamics of trust in their collaborations.

3. RESEARCH METHODOLOGY AND CONDUCT

The major aims of this qualitative study were to understand the dynamics of trust in GSE and to shed light onto best practices to provide suggestions to industry on how to achieve trust in their collaborations. Our research questions were:

RQ1. How does trust evolve within distributed teams during the project life cycle?

RQ2. What are the best practices the teams engage in for building and maintaining trust?

RQ3. What are the suggestions for the industry to achieve trust in distributed collaborations?

In order to answer these questions, this research was designed as an exploratory study. The following sub-sections discuss the data collection and analyses steps.

3.1 Data Collection

In order to collect data, we first prepared a questionnaire based on the findings of the current literature review (see Section 2) on the causes of lacking, injuring or losing trust in GSE as well as the suggestions for trust achievement.

Then, we conducted semi-structured interviews¹ (10 one-hour interviews) with project managers from six different software organizations (involved in eight different GSE projects) to explore further the dynamics of trust as well as the best practices in the industrial settings.

We selected the interviewees to represent different nationalities (Malaysia, Iran, Serbia, Sweden, and South Africa) under the constraint of the availability of participants. Furthermore, it was critical to include different trust cultures in this study to be able to observe the different trust building and maintaining behaviors since trust is very much dependent on people’s actions and perceptions that can be influenced by their cultural backgrounds.

In addition, we aimed at covering different types of business relationships in our case projects. Three projects were offshore insourcing and four were offshore outsourcing projects. Only one project was an onshore outsourcing project and none were onshore insourcing projects (see Table 2).

Some of the interviews were conducted via Skype and some through meeting in person depending on the distance and the interviewed manager’s preference. We used a qualitative research analysis tool, called NVivo 8 [29] to store and analyze the collected data.

Table 1 summarizes the information regarding the case organizations, the case projects and the performed activities by the teams located at different locations. Even though we provide all the locations involved in the case projects, we conducted the interviews so that at least one trust relationship could be captured and analyzed. The projects and the involved parties, for which we could have collected data, are shown in *italic* in the table. Detailed information about the interviews can be found in [18]. We cannot provide the names and further information regarding the organizations and projects due to confidentiality purposes. Instead, we use acronyms A, B, C, D, E and F to represent different organizations and numbers to represent different projects in which trustor and trustee teams collaborated.

Table 1. Summary of the cases

Project	Interviews	Investigated locations					Other locations						
		Country	A	Ds	Dv	T	M	Country	A	Ds	Dv	T	M
A	2	<i>Malaysia</i>		√	√	√	√	<i>Iran</i>			√	√	
								<i>USA</i>	√			√	
B1	1	<i>Sweden</i>		√	√	√	√	<i>Sweden</i>	√				
B2	1	<i>Sweden</i>	√	√		√		<i>Ukraine</i>			√	√	√
C	1	<i>Serbia</i>	√	√		√		<i>Sweden</i>			√	√	√
D1	1	<i>Sweden</i>	√	√	√	√	√	<i>China</i>			√	√	√
D2	1	<i>Sweden</i>	√	√	√	√	√	<i>China</i>	√	√	√	√	√
	1	<i>China</i>	√	√	√	√	√	<i>Sweden</i>	√	√	√	√	√
E	1	<i>South Africa</i>	√	√		√		<i>France</i>	√	√		√	
								<i>Romania</i>	√	√		√	
								<i>India</i>			√		√
F	1	<i>Sweden</i>	√	√				<i>Hungary</i>			√	√	√

A: Analysis, Ds: Design, Dv: Development, T: Test, M: Maintenance

Table 2 represents the information about the types of business relationships in each project. The given classification is inspired from [30].

We find it important to differentiate two major types of work relation for our further discussions in this paper. Among the studied organizations some projects formed co-located teams working on a separate phase or task independently. Others utilized virtual teams that consisted of distributed team members working jointly. The case overview is presented in Table 3.

Table 2. Case overview: Business relationships

Different countries	Offshore insourcing D1, D2, F	Offshore outsourcing A, B2, C, E
	Onshore insourcing	Onshore outsourcing B1
Same country	Same organization	Different organization

Table 3. Case overview: Distributed project organization

Projects	A, D1, D2, E	B1, B2, C, F
Performance	Joint	Independent
Teams	One virtual team	Several distributed teams

3.2 Data Analysis

We analyzed the collected data to investigate the trust dynamics (how transition among trust states occurs and why) among distributed teams in each project life cycle and to identify industrial best practices for building and maintaining trust.

Data analyses were performed using Grounded Theory² (GT) through applying open, axial, and selective coding techniques [38]. The resulting codes were re-checked for consistency and clearness before proceeding further for constructing the final outcome of this study.

Data analysis started with an open coding [38]. Interview text was reviewed to identify sentences about causes of lacking/losing trust, and related practices. The text was labeled with proper keywords. Similar codes were grouped together under a more general concept. Later, these concepts were grouped into categories. The following example explains 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

¹ A semi-structured interview is flexible and allows new questions to be brought up during the interview as a result of what the interviewee says [10].

² By GT, the actual data of the real world is examined and analyzed in order to draw grounded theories [13]. GT suits well for exploratory investigations when there is no prior knowledge of a part of the reality or a phenomenon and no preconceived hypothesis [10].

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 the literature. Therefore, it was coded as “Linguistic Differences”. Furthermore, the applied practice was stated as “Email”. The second case addresses the same cause, but the practice is “IRC chatting”. Therefore, 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”. Then, “Linguistic Differences” was grouped with other causes of lacking/losing trust and their consequences in a general category of “Threats”. Hence, the threat-practice relationship was recognized.

In the following sections, we present and discuss the results of the analyses on the collected data. First, we discuss the trust state transitions during the life cycle of each project. Then, based on these states, we present a trust dynamics model for GSE projects life cycle. Finally, we discuss the identified best practices in relation to the trust life cycle.

3.2.1 Trust State Transitions

For the following discussions on the trust state transitions within each project, the icon ☺ demonstrates the state of *trust*; ☹ represents the state of *distrust* [21]; and ☺☹ represents the state of *neither trust nor distrust*.

For each project, the first location in the shown relationship represents the trustor organization and the second – the trustee. The trustor is the product owner and the trustee is the team, which the trustor chose to collaborate with for that particular project. We investigated the trust relationship considering the perspective of our interviewees from either the trustor or the trustee teams.

Project A. Malaysia (trustor) ↔ Iran (trustee): ☺ → ☹

The virtual team including members located in Iran and Malaysia started their collaboration with a strong initial trust. The reason for the strong initial trust was stated to be the fact that many members of both teams had worked in the same co-located team previously. This initial trust in return facilitated effective communication among teams. Some practices were also planned at the beginning of the collaboration and performed during the project to maintain and improve trust (see the best practices in Section 3.2.3). Moreover, the progress was communicated daily and members of the virtual team were in contact via chat during the overlapping working hours and discussed the project-related issues. The common language spoken in Iran and in Malaysia helped in making the communication easier. The trust was maintained and improved until the end of the project.

In this case organization, we interviewed two different project managers from the trustor organization for the same project. They both had similar applied practices, which points an organizational awareness about the significance of trust and joint decisions for trust achievement.

Project B1. Sweden (trustor) ↔ Sweden (trustee): ☺ → ☹

For this project, we interviewed the trustee team. Since these teams were collaborating for the first time, the initial trust state was “neither trust nor distrust”. However, in the past, the trustee team collaborated in another distributed project with another

trustor team, which had been a failure. Therefore, they previously had a negative experience in such distributed collaborations.

During this project, although a number of practices were performed to build and maintain trust among the teams, the teams could not build trust to the end of the project. The reasons were stated as the requirements and quality expectations were not well negotiated early among the teams. As a result, even though the final product was delivered with high quality according to the trustee, it did not satisfy all of the expectations of the trustor and thus, the trust was lost.

Project B2. Sweden (trustor) ↔ Ukraine (trustee): ☺ → ☹☺

This case project was also the first collaboration between the trustor and the trustee teams. Therefore, the initial trust state was “neither trust nor distrust”. During the project, the Swedish team lost trust in the Ukrainian team in performing tests and verifying their work before delivery since the final product was delivered with many defects. However, later, the Swedish team continued to work with the Ukrainian team by changing the expectations, which was to still delegate all development responsibilities to the Ukrainian team, but re-test their work in Sweden. It was much cheaper to outsource the development to Ukraine and re-test the final product rather than developing and testing the product in Sweden.

The commonality of these two projects was the use of too few practices for addressing trust challenges. Although in Project B1 more practices were implemented than Project B2, the trustee could not meet most of the expectations of the trustor and the trust was totally lost and the collaboration terminated.

Project C. Sweden (trustor) ↔ Serbia (trustee): ☺ → ☺

Since there was no prior experience of working together in this collaboration, the Swedish team evaluated the trustworthiness of the Serbian team based on their expertise. Therefore, there was no strong trust state at the beginning. During the execution of the project, the Serbian team showed high performance and were able to meet deadlines. Furthermore, they maintained frequent informal communications with the Swedish team. The main success factor was stated to be the effective and frequent communication among distributed teams along with facilitating informal knowledge sharing. Instant message tools were used to decrease the delays in communication. This also increased the frequency of communication. In addition, they logged and kept track of the history of text messages for traceability and conflict resolution purposes in future. The collaboration ended in a trust state.

Project D1. Sweden (trustor) ↔ China (trustee): ☺ → ☺

The collaborating virtual teams in this project were offshore locations that belong to the same organization. The teams started with an initial state of “trust”. During the life cycle, exchanging team members and meeting schedule and quality expectations maintained trust.

Furthermore, they planned for frequent face-to-face meetings and traveling between the sites in advance. In critical situations with high face-to-face interaction demands, key team members from Chinese team traveled to Sweden and worked together.

Project D2. Sweden (trustor) ↔ China (trustee): ☺ → ☺

In this project, we interviewed the project managers of both the trustor and the trustee teams. The offshore locations in this project also belong to the same organization. The teams started with an initial state of “trust”. Daily short informal meetings through conference calls were conducted to exchange information and to communicate the status of the project.

In both projects in this organization, starting with trust state and performing many practices to maintain and improve trust helped complete the projects with success and in a trust state.

Project E. South Africa (trustor) ↔ France (trustee): ☺ → ☺

In this relationship, the status of the initial trust was “neither trust nor distrust”. The South African team relied on the technical competence of the French team to start the collaboration. This organization was experienced in distributed projects. The interviewee was very well aware of GSE challenges and trust specific problems. The activities were planned well and the tasks were distributed among the locations. Task dependencies between the teams were minimized while partially dependent tasks were assigned to the teams separated by a small temporal distance. Moreover, the South African team clearly set the quality expectations and asked the French team to use specific standards and shared templates. They were able to build and maintain trust throughout the project life cycle despite the challenges of task distribution within different teams.

Project F. Sweden (trustor) ↔ Hungary (trustee): ☺ → ☺

The Swedish and Hungarian teams worked for the same organization in the past. Therefore, Swedish team initially trusted the other team from the beginning. During the project, the teams were able to maintain trust by regularly negotiating each other’s expectations and keeping promises.

After analyzing the trust state transitions in the case organizations, we further investigated the general dynamics of trust by exploring the patterns in the cases. The results are presented in the next section.

3.2.2 Trust Dynamics in the Life Cycle

We used the concepts and components (the trustor, trustee, trust object, and trust environment) of Schultz’s situational trust model [34] in order to model the general trust dynamics within the distributed project life cycles by exploring the case projects (see Figure 1).

There are two phases of trust in distributed collaborations: the initial trust building phase and trust evolution phase. The initial steps in the diagram can be viewed as initial trust building phase, which ends when “trust” state is achieved after the expectations are agreed. The first phase is called as static since the project starts after this phase when an acceptable level of trust is achieved.

During the initial trust building phase, there is an interaction between the trustor and the trustee. The initial trust state of the trustor is based on the previous situation specific interactions with the trustee. In the case of no previous interaction, the trustor relies upon former experiences and/or evaluates the trustworthiness of the trustee. Therefore, the initial trust state can also be a state of no strong trust or distrust. Based on this knowledge, the trustor

sets the expectations from the trustor and the trustee perceives these expectations.

When an acceptable level of trust is built (based on the expectations) the collaboration starts, and this “trust” state initiates the dynamic phase of trust evolution. During the project life cycle, the trust state might continue to be maintained, injured and rebuilt, or totally lost. As long as the actual behavior of trustee is matching with the agreed expectations, trust is maintained. The resulting trust state (“trust”, “distrust”, or “injured trust”) is based upon the trustor’s perception of and experience with the trustee, the trust object, and the environment.

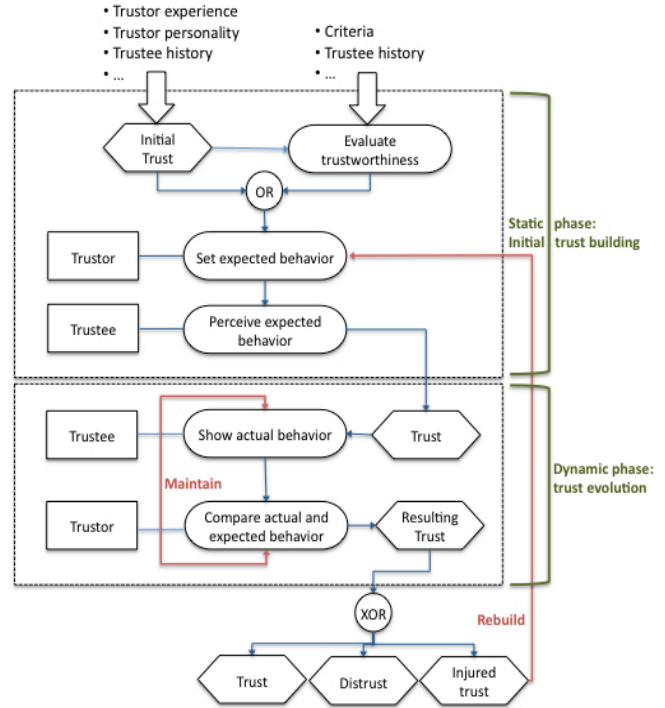


Figure 1. Trust dynamics in the project’s life cycle

The resulting trust state can be observed as “initial trust” for the future collaboration possibilities. When the previous collaboration completed in a “trust” state, in the new collaboration the trust is usually built and maintained easier. On the other hand, “injured trust” (trust is partially lost) or “distrust” (trust is totally lost) states might terminate any further collaboration. In such a situation, the trustor party makes a decision whether changing the expectations (the trust object) or the environment might help to “rebuild” the trust. (See Section 3.2.1 for more details on trust states transitions in case organizations).

3.2.3 Best Practices for Trust Achievement

In this section, we present the identified best practices for trust achievement. For each practice, information on the source organization along with a brief elaboration is provided. Recommendations in each category are ranked considering their popularity, i.e. how often the practice was mentioned by the interviewees. Hence, the ranks of the following recommendations represent their popularity among case organizations. Table 4 maps the identified practices to the investigated case projects.

Table 4. Map between recommendations and organizations

Info.	Recommendation Number													
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Project	A	√	√	√	√	√	√		√	√	√	√	√	√
	B1	√	√	√			√							
	B2		√				√							
	C	√	√	√	√	√		√						
	D1	√		√					√	√		√	√	
	D2	√	√	√	√		√	√		√			√	√
	E	√	√	√	√	√		√	√		√			
	F	√	√	√	√									

Recommendation 1 Organizations: A, B, C, D, E, F

Plan the communication and regular meetings in advance

Planned communication prescribes defining media, contacts, timelines, rules and regulations. Regular meetings can be held either face-to-face or over (video) conference calls. These increase the predictability and ensure frequency of communication.

Recommendation 2 Organizations: A, B, C, D, E, F

Prevent misunderstandings

The frequency of misunderstandings during communication of the distributed teams is high. It is stated to be critical to identify the major causes and to address them early in the life cycle. For example, one significant reason was identified to be poor language skills. During the interviews one of the comments to overcome this issue was to utilize written rather than oral communication especially when the teams do not have very good level of the language used for communication.

Recommendation 3 Organizations: A, B, C, D, E, F

Encourage informal communication

Any kind of informal communication may compensate the lack of socialization in GSE. It can be achieved through unplanned chat or calls.

Recommendation 4 Organizations: A, C, D, E, F

Use common work processes, shared templates and standards

Teams working on the shared tasks shall agree upon the work processes, otherwise team members usually experience confusion and misunderstandings, for example, when integrating the work of different parties.

Recommendation 5 Organizations: A, C, D, E

Minimize delays in communications and in conflict resolution

Utilizing synchronous communication methods together with distributing dependent tasks among close time zone locations shortens response time. Moreover, it is crucial to communicate the issues and conflicts immediately to resolve the conflicts as early as possible.

Recommendation 6 Organizations: A, B, D

Collect regular status reports from each team member

Status reports help project managers to monitor the performance of the team members, to track the project progress and take timely actions; thus avoiding injuring trust due to time and cost overruns.

This practice also helps in building cognitive-based trust and avoiding over-control of the remote team members.

Recommendation 7 Organizations: C, D, E

Make the communications traceable

Keeping the history of communications provides the possibility to review the communications later if a conflict happens. Furthermore, tracking the decisions for a specific matter becomes easier.

Recommendation 8 Organizations: A, D, E

Cooperate closely in the case of an urgent need

In few occasions such as high task dependencies or in solving severe conflict issues, face-to-face and close cooperation is highly recommended. This can be achieved, for example, through staff exchange.

Recommendation 9 Organizations: A, D

Gain cultural awareness

Before and during cooperation with remote sites, it is crucial to gain awareness of cultural differences either through experience or training.

Recommendation 10 Organizations: A, E

Be available for your remote colleagues

Availability is an important factor for the team's cohesion. It reduces delays in communication and improves the links among remote team members.

Recommendation 11 Organizations: A, D

Exchange team members across locations

This recommendation alleviates the lack of face-to-face meetings through socialization. This stimulates active information exchange between teams during and, most importantly, after the co-location.

Recommendation 12 Organizations: A, D

Encourage sharing of best practices among distributed teams

Encouraging team members to share best practices increases the "teamness" feeling among them and helps to achieve the shared goal.

Recommendation 13 Organizations: A, D

Encourage use of video in communication

The interview results suggest that video can partially compensate the absence of meeting in person and significantly improves communication.

3.3 Validity of the Study

Below, we discuss the validity threats regarding reliability and generalizability of this research and what we did to overcome.

Internal Validity. Internal validity aims at ensuring that the collected data enables the researchers to draw valid conclusions [10]. Therefore, the transcript of each interview was prepared immediately after the interview to minimize the risk of forgetting some parts of unwritten information since the interviews were not recorded. Furthermore, the transcription document was sent back to interviewees to confirm the content.

It should be noted that there is not much evidence in the current research literature to believe that the results of face-to-face interviews vary from the Skype-based. Therefore, conducting interviews in two different ways (face-to-face and over Skype) has not affected the quality and reliability of the results of this study.

However, triangulation technique (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) [15] was applied to ensure the internal validity of the research. The triangulations used in this study were data and investigator triangulations.

Data Triangulation. The data was collected during the interviews with managers who have different experience and expertise. The interviews were designed in a way to avoid directly relating the questions to trust issues. A small sample of participants from the senior developers working at Swedish organizations and senior software engineering students studying at Blekinge Institute of Technology also checked the questions before conducting real interviews. Hence, the content was refined until we agreed that questions are clear enough for interviewees.

Investigator Triangulation. In data collection and data analyses, more than one researcher was involved in performing and validating the work. Other researchers reviewed the findings from each researcher and comparison was made to ensure that their conclusions were similar.

One limitation of this study was that the data could not be collected from both trustee and trustor parties involved in the case projects due to availability reasons. However, we believe that this would not significantly affect the reliability of the discussions and contributions of this study. First, the final trust state is associated with the outcome of the business relationship, thus trust should not be subjectively misperceived and both trustor and trustee are expected to have the same perception about the final trust state. Second, the identified practices were performed during the collaboration of both parties and therefore should not be different.

External Validity. External validity defines to what extent findings from the study can be generalized to and across populations of persons, settings, and time [10]. Hence, proper actions to overcome relevant threats were considered in the design of this study.

This research aimed at finding practices that would apply to different types of collaborations of distributed teams. Project managers working in different companies collaborating in different ways with other teams to develop different types of software products were interviewed (see Section 3.1 for more details). Moreover, in order to increase cultural diversity of the population, we interviewed the managers from the organizations located at different parts of the world (Asia, Africa, and Europe). Even though the details of projects are not available, the discussions presented in this study can be generalized for similar contexts e.g. offshore development.

There is not much reason to believe that the best practices can be generalized over time. The technology is evolving and new tools will be introduced to support best practices. However, we believe that the dynamics of trust will still be valid over time.

4. CONCLUSIONS

This study explored the dynamics of trust and best managerial practices to overcome the challenges of building or maintaining trust during the collaboration of globally distributed teams.

Based on our findings, we suggest managers who start a distributed collaboration to consider the following factors.

Trust dynamics. The trust dynamics model developed in this study revealed that initial trust building is a static process in which the trustworthiness of the trustee is evaluated and the expectations are negotiated. One outcome of this is that if the expectations were not clear and well-set from the beginning, the practices conducted in the following dynamic phase to achieve trust when the project starts, do not help much since there is a high risk that trust might be injured (the behavior of the trustee not match with the expectations of the trustor due to this unclearness). If this situation is avoided from the beginning, then it is critical that project managers should plan and engage the team members in practices towards maintaining and improving trust.

The type of business relationship. Our observations indicate that business relationship has a significant effect in determining whether the project will start with a strong initial trust. In the investigated organizations, teams that were formed by members of the same organization shared corporate identity and thus implied the trustworthiness of the trustee. On the contrary, lack of previous collaboration experience and shared organizational background hindered strong trust at the beginning. This may motivate the managers to invest more in trust and cognition achievement activities.

The role of management. The best practices presented in Section 3.2.3 highlight the role of managerial actions in the trust relationship between distributed teams. A success factor for trust was recognized to be the “awareness” of the particular challenges in GSE. Especially, good communication management, which addresses these challenges, is essential.

An important observation in this study is that all of the managers participated to our qualitative study expressed a great interest in this study and to our findings. They also mentioned the need to further investigate trust-related issues as well as ways to achieve trust in GSE to be able to learn from others’ experiences.

As the future work, we suggest conducting a similar study with the software developers to explore their viewpoints and awareness in comparison to project managers.

It would also be interesting to investigate further how different collaboration settings such as nearshoring and farshoring would affect the trust dynamics and trust building and maintenance practices.

5. ACKNOWLEDGEMENTS

We would like to thank Branislav Zlatkovic for his great help and participation in the data collection and analysis phases of this study. We also thank our interviewees for giving us a part of their precious time, the valuable information and useful feedbacks. Our great gratitude goes to Professor Claes Wohlin for his review, guidance and useful suggestions.

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