Contemporary transnational collaboration in IT development

A case study in the roles of engineering culture

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Abstract
Today’s transnational IT development requires complex collaborations which are often hindered by differences in the culture, geography (time zones), and the work habits of the people involved. This study was conducted in the real-world environment of a global telecom company. The data demonstrates some of the problems which can arise when attempting transnational IT development, particularly in the field of engineering.

Using case study research method, collaboration barriers can be found and research insights are generated from collaborative interruptions and communication behaviors. Although technologies and working principles do enhance performance, I argued that social considerations in transnational collaboration are needed to study as top priority. Particularly in the engineering working context, most people are often either unaware of potential collaboration conflicts or unprepared to solve them. In some technology solutions gaps are existed between human’s intentions and practical supporting functions.

In this paper, the finding shows that social considerations in transnational IT development result significant influence to collaboration which clears the picture and brings more understanding between individuals, mechanisms and IT products. In addition, this study also confirms that social approach does increase certain level of improvement in transnational collaboration.

1. Introduction
In order to invent cutting-edge information technology (IT) efficiently, transnational collaboration has become the primary business model employed to maximize the value of consequences. In addition, the global IT collaborative environment requires the integration of participants from a vast array of cultural and language backgrounds, each accustomed to their own distinct methods of collaboration and mechanisms of production. However, one aspect that most people often ignore is the social consideration. today’s management strategy in collaboration mechanisms stands that social consideration can not only define individual’s responsibilities properly but also help engage in multiple activities, and deal with additional multinational and technologically sophisticated environment (Thamhain, 2004); therefore, this statement implies individuals and organizations in IT development need to understand social challenges explicitly in order to face up to transnational issues such as cultural difference, geography (time zone) and different working habits and so on. Moreover, a researcher suggested that the transnational project management needs to face more and more complex social processes of the individuals involved (Adenfelt, 2010). It is unlikely in IT development that even the most brilliant alliances can reach their full potential unless cultural and social perceptions are addressed (Boudreau et al., 1998). Solutions to global IT challenges cannot be achieved in isolation. A recent research approaches development of meaningful IT solutions in different countries requires much attention in localization, because, put simply, what works in one location doesn’t always work in another (Wyche, 2011). In fact, each collaboration pattern has its own perceptions so that reproducing the success of single experience is hard to imitate and may not valid in each case. The importance of approach local information is necessary rather than obtaining information which does not belong to the particular context.

Culture, is certainly related to collaboration due to a diversity of angles such as national presentations, concept value of enterprise, occupational perform and so on. In this paper,
transnational IT collaboration encompasses many professions; however, the main focus is solely on the field of engineering. Keisler et al. (1985) stated that “It is embedded in a social system consisting of shared values and norms, a special vocabulary and humor, status and prestige ordering, and differentiation of members from non-members. In short, it is a culture.” To narrow down a specific area – engineering profession can help understand collaboration behaviors in the whole IT environment. Previous research found that engineers tend to be task-oriented and prefer to work alone rather than with others. These traits are a part of the engineering culture (Leonardi, 2003). They are a result of an engineering educational system which places a premium on technological knowledge and the ability to apply that knowledge to enhancing the quality of technology. Not surprisingly, the development of interpersonal skills has been given little attention in the engineering environment. However, interpersonal skills are also involved partly in communication activities at work. Communication, a key component of any collaborative task, is affected by social differences. According to White et al. (2010) statement - “internal communication has been recognized as a strategic focus for business communication, second only to leadership concerns.” “Communication” refers not only to the explicit exchange of information, but also to the ways in which people work.

With modern, increasingly-global collaborations, how people go about their work becomes even more important. Attempting to solve distributed collaboration issues, computer-mediated technology has been developed to help set project standards for all involved. However, technology is limited when it comes to dealing with the social differences of the collaborators (Bradner & Mark, 2002). This paper argues that most digital interactive interfaces developed to date have not taken into consideration the social-technical gap between human beings and technologies (Ackerman, 2000). This is, technology has been unable to solve the differences that arise from being human.

1.1 Challenges in contemporary transnational collaboration

This study applies the case study research method (Yin, 1994) to gain a better understanding of contemporary transnational collaboration and to identify how growing IT development is affected by transnational factors in terms of social considerations. According to Yin’s statement (1994), having a fieldwork to accomplish study purposes is permitted so that the empirical target is a global telecom company, which employs more than 20,000 engineers worldwide and often requires transnational collaboration. By using exploratory research to investigate the outcome of transnational collaboration with a single division (identified as “SHW” below), the importance of demand is shown that contemporary IT development needs to approach not only sophisticated technical challenges but also complex and multi-activities working contexts (Nelson & Stolterman, 2003; Stolterman, 2008). Given this background above and the consequence of contemporary IT development, a critical topic in this paper is needed to study deeply in terms of transnational related considerations (Wyche, 2011). Based on the idea of transnational collaboration, the research scope is formed into a particular context – engineering culture (Leonardi, 2003) to understand its impact on activities at work. Moreover, many interactions in IT development are also needed to understand how to complete transnational activities by integrating various resources such as manpower, supporting devices to exchange information and social mechanisms and so on.
The purpose of this study is to investigate how transnational collaboration has changed contemporary IT development. The analysis is shown based on following research question:
1. What are the barriers for transnational collaboration in contemporary IT development?
2. How can the social considerations enable efficient transnational collaboration?

In this paper, an introduction of methodology will be presented in charter two where I apply case research method to look for findings. Based on case study research method, several related research are described in chapter three, which is given direction to this study. Next, in chapter four, a detail field study investigation will be illustrated in order by two different cases. According to chapter three and chapter four, a demonstration of analysis will represent the problems in chapter five. Regarding to the finding, design suggestion, in chapter six, is proposed in several ways. Finally, chapter seven concludes this paper by detailing answers to the questions put forth in this study.
2. Methodology

Case study research is the primary methodology employed in this study. It is an ideal methodology for an empirical inquiry, particularly in sociological studies (Yin, 1994). According to Yin (1994), case study research can be used for theory-building and theory-testing by emphasizing detailed contextual analysis and supporting multiple data collections and qualitative evaluation. Ethnography methodology is recommended by Merritt (2011) for transnational HCI user research. It involves positioning a researcher within a group of people for transnational HCI user research. This method was rejected for this study because, according to Yin, it requires long periods of field study and emphasizes detailed and observational data, which are impossible to achieve here, given the time constraints of the study. Yin (1994) gave clear definitions of the purposes, disciplines, and benefits of case study research. This method is particularly well-suited for contemporary phenomenon within a real-life context, especially where the boundaries between phenomenon and context are not clearly evident. Moreover, a case study allows for multiple sources of data which help ensure the validity of data collection and analysis.

Using Yin’s (1994) case study strategy, this paper will: (1) study previous research in order to define the research question; (2) select a target for empirical study; (3) design respondent questionnaires and select multiple data collection methods; (4) gather qualitative data in the field; (5) analyze the collected data; (6) formulate an answer to the research question and determine how it may contribute to future research theory.

2.1 Background of empirical case

The empirical study was conducted within, and with the cooperation of, a telecom company in Sweden. The specific target was a product development project in a division referred to in this paper as SHW. SHW is responsible for hardware design and most products relating to radio network solutions. SHW is a cross-functional organization, which allowed this study access to both project development and line management personnel. SHW operates using a diversity of complex communication methods to achieve transnational collaboration between global participants from a variety of cultures and environmental settings. These features combine to make SHW an attractive target for this study.

Two current transnational collaboration projects were chosen for this study. Although the criteria of building teamwork are different, the study allows referring to their positive and negative experience for getting more proper insights. Project R11 involves radio design. Project R12 is much larger in scope than R11, and too large for the limits of this study. It required I limit my focus to the radio design and cabinet design aspects of the project. Radio design, as the name implies, involves the development of radio transmission equipment. Cabinet design involves the development of housing for the radio equipment.

2.1.1 Project R11

Project R11 is a standard project comprised of teams (see figure1) in Canada (EMC), China (CBC and ENC) and Sweden (KI, LN and KL). KL is a production factory for Canada and Sweden while ENC is also a production factory for the great China area. KI, LN, EMC, and
CBC are jointly responsible for design work. The project was initialized in Sweden from KI and divided into several sub-projects to Canada and China.

![Collaboration relationship in project R11.](image)

*Figure 1: collaboration relationship in project R11.*

The development process is divided into three phases (see figure2). The process begins with component development in the R&D unit. This is the foundation to product development so most participants in my data are from this level. The component work is passed on to the higher level R&D unit, where design moves from the component level to the product level. In this phase, products are almost mature enough to release to the market. The commercial product on the top from figure2 is a final phase in project R11 development. Here the production is ready to implement to clients.

![Project development illustration in R11.](image)

*Figure 2: the project development illustration in R11.*

### 2.1.2 Project R12
Project R12 uses a new working concept called HW scrum. Unlike project R11, project R12 employs a small team located in the same workplace in Sweden. This allows for streamlined management and quicker response times. The core strategy of project R12 is to achieve low cost and shorter lead times in product development.

### 2.1.3 Comparison between R11 and R12
- **Some features of project R11:**
  
  Large long-term projects inherently require complicated organization charts. More time is needed to establish guidelines and responsibilities. That is, it takes longer to determine what will be done by whom, when, and where. Meanwhile, manpower allocation is set part-time support (approximately 15%~20%) and people usually work parallel in several projects is
because of project schedule. Nevertheless, cultural differences significantly affect communication in establishing how the project will be accomplished, which in turn increases risk, cost, and lead-time.

- **Some features of project R12:**
  Smaller groups work in a single location which allows for full-time support, well organized meetings, and the opportunity to share and raise urgent problems immediately. It is not surprising that this practice was given positive feedback from respondents. However, this new working concept so far could be efficiently implemented into projects within certain criteria – based on mature platform to develop new frequency products.

## 2.2 Data gathering

The case study research method requires basic skills in data collection. The researcher is required to ask questions, listen well, and interpret responses. The researcher must be adaptive and flexible to ensure the quality control of the empirical data (Yin, 1994). Yin identifies six valid sources of data collection: documentation, archival records, interviews, direct observations, participant-observation, and digital artifacts. Maintaining a chain of data increases the reliability of the information. Using these sources, a case study database is established, analyzed, and conclusions are drawn (Yin, 1994).

### 2.2.1 Cultural Probe

A cultural probe (Gaver et al., 1999) is a non–traditional ethnographic (cultural) method used to study new environments (McDougall & Fels, 2010). It was the first method I used to generate ideas. My intentions were to better know my study target and gain insight into how culture affects contemporary transnational collaborations. A probing kit was given to each respondent. The kit (see figure 3) was comprised of visual aids intended to facilitate honest communication of emotions brought on by collaboration. This pilot study involved five participants. Participants were requested to place emotional faces into different project phases and explained experience in contexts.

![Figure 3: Cultural probe kit contains emotional faces and customer journey board.](image)

### 2.2.2 Five manners from case study research for data gathering

Five sources of data based on Yin’s suggestions were chosen. Additionally, a cultural probe was used to collect data from 37 respondents (see table 1) regarding their work habits, ways of
communicating, and opinions regarding transnational collaboration. There are 32 respondents from project R11 and 5 from project R12.

<table>
<thead>
<tr>
<th></th>
<th>Canada</th>
<th>China</th>
<th>Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project R11</td>
<td>5</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>Project R12</td>
<td>-</td>
<td>-</td>
<td>5</td>
</tr>
</tbody>
</table>

Table1: Overall participation statistics of field study.

- **Documentation**
  Documentation source data can be used to better understand the specific purposes of a project and the audience for which it was written (Yin, 1994). In order to understand how SHW works, I researched their documentation source data, Hardware Development Process (HWDP) because this is a standard working concept in SHW. HWDP, allowed me to follow document generation and learn about project tasks and milestones. In short, HWDP is the product development bible in SHW.

- **Interview**
  In order to have direct insight of case study, I have chosen the focused interview. The focused interview allows a functional, straightforward approach to gaining insight into day-to-day situations that arise while collaborating, and sort out discrepancies between anticipated and actual results (Merton & Kendall, 1946). Following Yin’s recommendation (1994), I encouraged open-ended responses from respondents’ regarding problems they’ve encountered during collaborations and their reflections toward improvement. This inquiry (see table2) consisted of 37 participants, most of whom were Swedes. The participants ranged from higher project managers, to lower project managers, to leaders, and finally to engineers. On-site R11 and R12 interviews were performed face-to-face in Sweden only. Off-site (CBC, EMC, ENC, KL and LN) interviews were conducted around 15 times by phone and Sametime (Sametime is a software from IBM which provides real-time shared computer’s screens function) in project R11. The same questionnaire (see Appendix A) was used in all instances. The questionnaire focused on work methods, usage of communication tools, social relations, cultural differences, and other areas relative to this investigation. The duration of the interviews was limited to one hour. They were digitally recorded and transcribed for later analysis. The big difference between face-to-face and phone is the contextual approach. On-site interviews can see the interactions between individuals and tools and reflection to transnational collaboration.

<table>
<thead>
<tr>
<th></th>
<th>Canada</th>
<th>China</th>
<th>Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project R11</td>
<td>Face-to-face</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Phone</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Project R12</td>
<td>Face-to-face</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table2: Participation statistics of interview by face-to-face and phone.

- **Direct observation**
  Field visits are an important component of research and necessary for gaining first-hand knowledge of interactions in the workplace (Yin, 1994). Thus, I spent one day to visit one manufactory (KL) to interview and observe collaboration. In addition, direct observation of,
and interaction with, social groups in their day-to-day work environments is an invaluable aid as it allows the researcher to receive immediate feedback in real-time situations (Rubin et al., 2005). I took detailed notes during my field visits and made digital recording when rules permitted.

**Participant-observation**

Participant observation offers an opportunity to join daily field work and increases opportunities to broach topics with the participants (Yin, 1994). The downside, according to Yin, is that the researcher may lose their objectivity when interpreting the data. The benefit of applying this method is an opportunity to find potential key data (Beyer & Holtzblatt, 1999). I chose to observe regular meetings in SHW because meetings are the most common cooperative activities in SHW, and allow the best opportunity to observe communication interaction. I identified two types of meetings: face-to-face and teleconference (see table3). I observed these meeting without participating.

<table>
<thead>
<tr>
<th>Meeting types</th>
<th>Location</th>
<th>Communication tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face</td>
<td>Conference room/office</td>
<td>White board, laptop, projector</td>
</tr>
<tr>
<td>Teleconference</td>
<td>Conference room/office</td>
<td>Laptop, projector, telephone, Sametime</td>
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</table>

*Table3: Two types of meeting settings.*

The majority of meetings I observed were held using teleconference by Sametime, an IBM, PC-based communication tool which allows staff to share computer’s screen from individual workstation. I attended nine teleconference meetings and two face-to-face meetings. In project R11, I took part in technical meeting, project core team meeting and reporting meeting. Each meeting was within one hour and I took notes for the interactions between staff and contexts. On the other hand, I participated in six face-to-face meetings in project R12. This was core team meeting which was held once a week in 15 minutes. I also took down notes in interactions between participants and contexts.

<table>
<thead>
<tr>
<th>Project</th>
<th>Face-to-face meeting</th>
<th>Teleconference meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>R11</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>R12</td>
<td>6</td>
<td>-</td>
</tr>
</tbody>
</table>

*Table4: Participation of meetings in project R11 and project R12.*

**Digital artifact**

In order to study historical data, I used a web application tool called HWDP 2000. SHW developed HWDP 2000 to generate standard project information such as milestones, documentation templates, and checklists. It also allows users to navigate project information based on project roles.

**2.2.3 Challenges and reflections**

The results of my cultural probe were disappointing. Participants found it confusing. The probe was meant to promote honest feedback for this study, but in reality did more harm than good. The probe required to participants to, in effect, record negative feeling brought on by the workplace. In hindsight, it is understandable that many participants were unwilling to “go on the record” with their complaints. As a result, I stopped using the cultural probe and instead confined my inquiries to interviews and observations. Although HWDP is the standard
working concept in both projects, transnational collaboration does not include all activities particularly in communication.

In the beginning of approaching interviewees, interviews were hard to see useful data because I was new for the environment and perhaps there might be political concerns during conversations. However, I realized that relevant information usually came after understanding individual’s collaboration patterns. To see is to believe in direct observation, which has been given some research insights. One of research insights was from an engineer in factory. He told me that different roles have different aspects to examine the work. The design work is usually looked perfect through computers; however, physical assembling needs to consider working efficiency and low cost. One benefit of speaking Chinese is easier to approach Chinese staff and collect relevant information.

2.3 Evolvement of research insights
By review empirical data can reduce some potential difficulties (Yin, 1994). He emphasized that this is just a prelude to evolve design opportunities. Thus, I used four means to formulize research insights.

- **Regular review**
  In order to validate my understanding of research insights, a regular review with one supervisor from SHW is necessary. The review was held once a week within an hour. I also had the review meeting with supervisor from University once a month by telephone. The discussions were based on empirical data to highlight several critical issues such as culture, working contexts, working habits and communication tools.

- **Personas and Scenarios**
  The personas and scenarios (see Appendix B) stress accuracy of design opportunities and approach the research question directly. Because each country has its concerns and reflections to see the current collaboration, I selected the most critical issue from each country and designed three different personas and scenarios. More specifically, case1 is the experience from Canada representing a feeling of isolation. Case2 is from China which encourages creating an open working environment. Case3 is from Sweden to show transnational training problems and its local working attitudes. Each case has its goals, stories and user flow. This is a guide that shows what and how to shape design suggestions (chapter6) so I can always refer to.

- **Workshop**
  According to Yin’s statement of analysis data, he encouraged to play with the data in a preliminary sense. Although regular review helps this study to keep focusing on right track, the purpose of having a workshop is to confirm and gather more insights by showing a draft design with a small group including three project managers and a supervisor from SHW. The workshop was held in an hour and recorded digitally. After having the workshop, an insight was given during the discussion. That is, a connection or method to bridge different group people is needed.

- **Presentation**
  Apart from the workshop, presentation is also a nicely opinion to inspire participants and receive feedback immediately. There were three presentations organized to three different
group people – management team, project managers and higher management team. The purpose of first presentation was to explain the design suggestion (chapter6) to management team in order to see possibility to implement and collect improvement as well. The second one was also to share the design suggestion but the audience is project manager. My intention was to inspire participants to create innovative creative transnational collaboration. The last presentation was to collect information from higher management team which widened the vision to the design suggestion (chapter6).

2.4 Literature review

This study attempts to contribute finding to the transnational collaboration in contemporary IT development where includes elements such as people, communication, culture, working context and collaboration mechanisms. The purpose of literature review is towards the research questions. Most related research is found from HCI, management and international business fields and major journals are selected on the basis of relevance from the research questions. In addition, the case study research (Yin, 1994) has been so helpful to understand the field study.

Despite the fact that many solutions were invented to solve transnational collaboration problems, I argued collaboration mechanisms in IT development processes have not yet been mature enough to eliminate all difficulties (Friedland & Yamauchi, 2011). The form of collaboration is hardly to arrange appropriately from place to place. There are five vital factors in transnational interactions: (1) people, (2) communication, (3) culture, (4) working context and (5) collaboration mechanisms. These are affected transnational collaboration obviously. First, in contemporary transnational collaboration, soft-related considerations influence the ways how people interact with at work (Hyypiä & Pekkola, 2011). When various backgrounds of people work together that multi-culture certainly exists in collaboration. Apart from national culture, in this study, is emphasized to navigate in occupational culture (Keisler et al., 1985). Engineering culture is chosen because the empirical study comes from a high-tech company. Regarding to Leonardi’s (2003) finding in engineering culture, engineers behave significantly by engineering culture which has been caused a lot of communication problems. Social-minded collaboration needs to train for engineers in order to improve their interpersonal skills. One research is linked to service concept towards social-minded of collaboration which encourages contemporary IT development to make a common sense in creating an understandable environment in collaboration (Nelson & Stolterman, 2003; Janlert & Stolterman, 2008; Heath & Heath, 2011). There is no denying that the communication behavior plays an important role in transnational collaboration (DeSanctis & Monge, 1998). Moreover, tools are also vital in transnational collaboration. CSCW is a research to study and provide IT solutions to solve collaboration concerns. However, technology somehow cannot avoid problems like social distance matters (Ackerman, 2000; Olson & Olson, 2000); therefore, the interruptions might occur sometimes when one does not interact properly to another (Harr & Kaptelinin, 2007). The new work concept in transnational collaboration particular in engineering culture is hopefully to contribute a useful practice in the end to this paper.
3. Related research to approach transnational interactions

The adoption of the transnational organizational model for a multinational enterprise is widely acknowledged as the preferred means of going global (Boudreau et al., 1998). Due to this trend, transnational collaboration has become more complex to arrange from place to place. To explore contemporary IT development, transnational interactions goes deeply hand in hand with people, communication, culture, working context and collaboration mechanisms. Researcher noticed the current HCI research mostly focuses on local considerations only (Wyche, 2011). She concerned the future IT development process should be more open to global perspectives. Previous research found transnational projects often have problems not meeting its time and scope objectives was because of coordination and communication problems (Adenfelt, 2010). Moreover, the importance of construction communication by technology within transnational collaboration strategy needs to highlight that social communication complements rather than substitutes for task communication in teams with persistent trust (DeSanctis & Monge, 1998). As the construction of interactive technologies is a common mean to connect transnational business, a CSCW theory is considered in this paper. This standpoint is that theatrical principles should be prior design of new technology instead of applying practical without concerning theoretical accomplishment (Barley et al., 2004). On the other hand, the culture issue is existed between various background people. This study emphasizes one types of culture called occupational culture. It has been illustrated the phenomena and identified by Keisler et al. (1985) that is a specific work style by sharing specific vocabulary and humor with particular people. Similarly research result was shown from Leonardi et al. (2005), work and culture as related but independent constructs (work is something members do and culture something members have). The occupational culture is, engineering culture in particular, a unique self-cognition from education that emphasizes professional value mostly (Leonardi, 2003).

Contemporary transnational IT development relies on various resources to complete and the main character is people. By seeking for people’s needs, the influence of transnational collaboration can be divided into two parts as following: (1) hard consideration is a discovery for current interactive technologies to understand their capabilities of dealing with transnational interactions. The other is (2) social consideration, which most people often ignore in collaboration.

3.1 Hard consideration

In order to eliminate difficulties on transnational interactions, IT solutions have become more and more common to apply particularly Computer Supported Cooperative Work (CSCW) is often used for solving collaboration problems. The CSCW theory is developed for direct individuals and organizations how to accomplish life goals appropriately (Barley et al., 2004). It has no deny that technology potentially increases knowledge to individuals but these researchers argued that new technology perhaps is an excellent design but, typically, little sustained work to develop first principles that can be applied elsewhere. Moreover, one finding is that the current IT mechanisms do not fully support the flexibility to social activity so that the social–technical gap comes (Ackerman, 2000).

Once the social-technical gap occurs between transnational teams, collaboration activities may have to force to address interruptions (Harr & Kaptelinin, 2007). The interruption
normally comes from a diversity of motives. For instance, due to computer system breaks down, people may stop working process. Furthermore, interruptions in teamwork come from various areas including technical issues and social effects. To identify and solve technical issues is easy whereas social effects are usually complicated to discover and understand. For social effects, are preliminary identified by Harr and Kaptelinin (2007) called “ripple effects”. They are: (1) collateral disruptions (question people on the same location), (2) freezing (synchronous communication between the interruptee and other people), (3) dropping the ball (remote consequences of the interruption on other people who depend on the outcomes of interruptee’s efforts within certain collaboration), and (4) various effect of the interruption on interpersonal relation between the interrupter and the interruptee.

Basically, CSCW facilitates collaboration among the transnational environment, and many technologies have been adopted for decades such as email, telephone, videoconference and computer systems and etc. To explore “virtual collocation” by CSCW, most demand from communication can be solved but social distance matters are still lack of flexibility (Bradner & Mark, 2002). Similarly, scholars declared some distance work is possible to overcome by using CSCW today, but some will never be impossible to support even in the future. (Olson & Olson, 2000)

### 3.2 Social consideration

The contemporary transnational interactions include not only hard consideration above but also social consideration is critical to confront. According to the description of challenges in CSCW development, the importance of dealing with social distance matter is apparently (Bradner & Mark, 2002). Indeed, when people collocate physically where you find them more likely to communicate frequently and informally (Whittaker et al., 1994). On the contrast, if people cannot physically collocate, and then how can they reach the fluent communication? Researchers have shown transnational communication is usually in the virtual contexts where are expected to be rapid, customized, and temporary (DeSanctis & Monge, 1998). In order to understand the social effects in transnational interactions, following two themes are divided: (1) collaboration mechanisms and (2) culture to discuss and find relevant inspiration to reflect the answer for the research question.

#### 3.2.1 Collaboration mechanisms

Mechanisms are the standard normally existing in the society, and these principles are made by human beings. These guide individuals to reach their goals. In this study, consideration of mechanisms in the workplace, organization management and communication strategy are needed to include.

- **Organization management**

  In organizations, “values are deeply embedded, tacit assumptions that are difficult to talk about and even more difficult to change.” (Long, 1997) Making a change for success in the reality is not as simple as making technological artifacts. It must need inspirations to the whole environment and team leadership for acceptation. Leadership, in contemporary environment, is one of important factors to decide whether to success because it usually inspires behaviors towards collaboration. Thamhain (2004) took a metaphor for project leaders – “social architect”, representing their responsibilities cover not only the latest tools
and techniques, but also the people, business processes, cultures, and value systems of the organization. It plays an essential role to workplace where the force can drive relations for performance and recognize barriers. Baumer & Silberman (2011) was given an example of “plant distribution” which represented technological intervention might be inappropriate. The story illustrated the advantage of social interaction is that asking the advice from gardeners may create additional value to the community. The benefit of social approach is not only for connecting people but also developing a positive attitude to become learning organizations (Ford & Voyer, 2000). Certainly, a sharing culture will aid people to develop common sense and keep maintaining mechanisms once they need to change (Friedland & Yamauchi, 2011). A successful transnational collaboration is definitely linked to knowledge sharing (Adenfelt, 2010).

Along the same line of thinking above, I referred to Heath & Heath (2011) argument to arrange a valuable mindset for transnational teamwork. They indicated “three things” method, which is needed to take emotion and rationality into account for making a change (Heath & Heath, 2011). The principle is to find out a positive idea firstly as for manager. Next step is to understand how to drive team members and final step is to draw a correct path for both roles to work together. The core strategy is to direct how to make the behavior change, which I will refer for later design suggestion.

● Communication strategy

Research found the interaction between leadership behavior and collaboration is deeply affected the ways of communication (Hyypiä & Pekkola, 2011). In particular transnational company, the communication strategy need to balance elements between employees, remotely location and communication technology. To employ E-communication is essentially a process of enactment, not interpretation that requires ongoing sense making and learning (Bansler & Havn, 2003). They also found the difficulty of current E-communication did not support two-way communication so people needed to use the existing communication media to keep collaboration (Bansler & Havn, 2003). Another finding is also relevant for definition of communication strategy is from DeSanctis and Monge (1998) that communication histories data can provide stability to develop within a group and guide knowledge sharing. Without a doubt, communication is crucial to the task activities and enactment of interactive technologies affects people significantly. Besides, a social-interaction perspective contributes a better understanding whether mediated discourse is workable in actual communication (Gluch & Raisanen, 2009). Based on a social-interaction, communication strategy is somehow related to culture, which I am going to describe in the next section.

3.2.2 Culture

In order to know how IT is affected by transnational interactions, culture is one of the crucial factors to investigate its background and current phenomena. In contemporary working environment, engineering culture (occupational culture) and design thinking culture are both relevant to this paper.

● Engineering culture (Occupational culture)

Many firms today rely on the quality, experience, and expertise of technical and professional workforce heavily that means human intellectual capital has become one of the most valuable, intangible assets in organizations (Long, 1997). Engineering culture, its core strategy has
made people have less interest to deal with social interactions (Leonardi, 2003). For an engineer or a student specialized in engineering, the nature mission is to find the right answers for problem-solving wherever at schools or in a workplace. Instead of dealing with complicated interpersonal relationship, most engineers would rather focus on enhancing technical skills to prove their value at work (Leonardi, 2003). Moreover, most engineers have hard time to express properly once the challenge involves complex social and political concerns. Instead of spending time on dealing with people, they tend to hide behind the problems and focus on increasing individual value. The communication activities for engineers, in general, tend to having technical conversation between people instead of social interactions.

Since education has emphasized capability of practical craftwork and sophisticated innovation but communication skills, most engineering students devote this mindset to work (Leonardi et al., 2005). Although universities try slightly to conduct solidarity into practical assignments, the core of education belief has never been changed. In fact, the working process within engineering culture limits project success due to poor communication between people (Ford et al., 2000). According to Leonardi’s (2003) finding, engineering culture has a strong influence to communication performance. He declared three important characterizations of engineers are an autonomous attitude, a scientific mind and a correct answer explorer. According to his research, engineers’ main target is simply to concentrate on getting “the right answer” that results in students to being blind to the none-technical world. This unhealthy awareness above has caused tensions in group work.

- **Design thinking culture**

On the other hand, the definition of the transnational collaboration process is crucial to IT development. Nelson & Stolterman (2003) provided a method to build up the process from “build trust”, “find common ground” and finally “create uncommon understanding” in a sense of design thinking way. More specifically, this is an action to pursue “not-yet-existing” target - “the real” which is represented human’s intention (Nelson & Stolterman, 2003). This concept can apply to identify the work process, which to image this is a cycle “... moving from the process of gaining uncommon understanding, to transforming this into a common understanding and then back again into an uncommon understanding and back yet again” (Nelson & Stolterman, 2003). In order to understand the role of transnational interactions, Service Design has given a new inspiration to encourage a positive working attitude that shows “One of the big challenges is to get people in the service industry to realize that they are involved in design and to get help to improve it” (Moritz, 2005). A service mindset in design collaboration process can make meaning by listening (Nelson & Stolterman, 2003). They (2003) declared that a service relationship on behalf of meaningful consideration, which shows to serve the right people, for the right purpose, at the right time. In short, a service mindset can certainly reach in-depth human matters and get more attentions to teamwork.

A notion of learning design thinking is to become part of the situation (Friedland & Yamauchi, 2011). They took Schön’s phrase to express the core of learning design thinking that is actual participation in designing (i.e. shaping engineering) in which experts can coach, not teach, learners. The design attitude building is based on assumption that is difficult to design a good alternative whereas assumption from the decision attitude is easy to come up
(Boland & Collopy, 2004). The potential effect on the design attitude is to generate good ideas instead of lack of alternatives, which is a key for IT innovation.
4. Case study: Telecom Company

An empirical study is conducted to look for the answer for the research question. This case study is collaborated with SHW by exploring their ongoing projects - project R11 and project R12. Table 5 is a demonstration of two types of project management. First to look at manpower allocation, the allocation of human resources is influenced by the scope of project. Thus, small scope project like project R12 has 100% manpower support because of short period missions while project R11 has part-time human resources support due to its long period schedule. Due to 100% allocated manpower in project R12, collaboration interaction resulted in a quick response whereas project R11 had slow and difficulty collaboration interactions. Another influence in collaboration is the distance matter. Obviously, distributed work is given restriction on selecting communication methods that result in a frustrating friendship because of lack of immediately response. Project R11 used Sametime and telephone mostly to hold discussions where co-workers shared their lived computer screens on particular object. However, in project R12, the white board is the only way to spread information, which is normally placed in a physical room where people can easily approach.

<table>
<thead>
<tr>
<th></th>
<th>Manpower allocation</th>
<th>Multi-sites co-work</th>
<th>Holding meeting</th>
<th>Information space</th>
<th>Collaboration interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>R11</td>
<td>15%~20%</td>
<td>Yes</td>
<td>Sametime</td>
<td>Email with attached files</td>
<td>Slow &amp; Difficulty</td>
</tr>
<tr>
<td>R12</td>
<td>100%</td>
<td>Yes</td>
<td>Physical room</td>
<td>White board</td>
<td>Quick</td>
</tr>
</tbody>
</table>

Table 5: Two types of project management.

4.1 General reflection on collaboration between three countries

A general reflection is nicely organized as a table (see table 6). First, three countries all agree that language is not a critical issue in collaboration. Besides, partly the information from Canada is hardly to collect because Canada has joined to this company for almost three years only so that not all respondents can answer questions once they related to Canada. Second influence is culture affecting working attitude, working pattern and working habit considerably. On the whole, Sweden has straightforward mind at work and focuses on certain responsibility only. China has heretical organization setup and high competition among working environment, which is hard to create transparency between collaboration. Besides, most respondents are unfamiliar with Canadian culture. Only idea from Sweden is that the ways of working in Canada is similar to Sweden because both of them are from the northern country. The third influence is affected by choosing communication methods. Email is the primary method to communicate for Canada and both China and Sweden prefer to take meeting as main way to discuss concerns. Moreover, office layout influences people to decide their communication methods. For instance, an open space layout is not suitable to have a long conversation by phone on the desk because this will disturb other people. An overall experience on support response is that the performance from Canada is good, and when it is critical, China performs quickly; however, Sweden’s performance is always slow.
Table 6: General reflection on collaboration between three countries.

The following descriptions are some opinions from each country, which is a reflection of collaboration.

- **Opinion from Canada:**
  1. Sweden: “B=not bad” due to difficulty to reach people.
  2. China: compared with Sweden, it was much easier to deal with. Many tasks activities are related to expertise that are located in Sweden. People are still learning to adapt themselves into new conditions so that they demand higher attention from expertise to help problem-solving. However, they mentioned the acknowledgement of the request from Sweden is hardly to see. On the other hand, although Canada has twelve hours time difference with China, a significant progress is shown in collaboration compared with Sweden. They always can receive the response by email from China.

- **Opinion from China:**
  1. Canada: no comments for it because of big time difference.
  2. Sweden: “OK”.

- **Opinion from Sweden:**
  1. Canada: “general good”.
  2. China: “4-” (a scale of 1~5) because the communication activity required highly focus. The collaboration with Canada is passive for Sweden because the expertise is located in Sweden. According to the past experience, the consequence of collaboration with Canada is general good. On the other hand, many participants indicated that high focus attention to review results from China is required. To supervise China needs more patience to face junior co-workers because Chinese people tend to change their positions frequently.

To sum up, table 6 has distinguished social effects to show general viewpoints by country. The current atmosphere within transnational collaboration has several standpoints from respondents as following.

1. Struggling in the new culture: Canada is still learning to adapt itself into this company’s culture.
2. Various working methods: each country has its own principles to handle projects.
3. Unbalanced working tempo: Sweden is recognized as the most slow response country.

4. Unclear initial setup: in the early project phase most respondents had failed experience to approach people from other locations. One finding is that a strong demand to know “WHO to ask”, “WHEN to reply” and “WHERE to find information” is necessarily to struggle a solution.

5. Restriction of communication: time difference is hard to organize a proper real-time discussion between countries particularly between Canada and China.

6. High demand market: a tight schedule is impossible to support frequently change. One insight is that over-optimistic assumption might make wrong decisions to affect further work performance.

7. Information explosion: communication data is existed in different information space through various interfaces without standardization. In fact, navigation correct information is a time-consumed activity.

4.2 Communication methods

The current communication methods rely on digital interactive technologies mostly but face-to-face communication is still used in collaboration particular when people locate in the same building. Here is the description of what and how communication methods are used in field.

4.2.1 Application

To begin with, as for file archiving, MS-Office software is the tool, which often to use in order to add extra explanations or record the communication activity. For instance, Excel is normally used for schedule planning and issue tracking management because of its simplified operation. Moreover, in order to manage files for different purposes, file folder with certain confidential control is the way to share project information. However, one drawback is that co-workers from other sites cannot access information directly. Another solution is web-based application, which is built to solve distributed collaboration. For example, Ericoll and EPP are both introduced to handle cross-state collaboration such as documentation management, announcement, project calendar and task management and so forth (Both Ericoll and EPP are generated by SharePoint where represent two interfaces to internal collaboration activities). Unfortunately, only few managers adopt Ericoll or EPP to handle projects because the configuration process requires certain IT knowledge and a great deal of time to establish a virtual working environment. Hence, managers would rather keep using physical notebook to handle project management.

4.2.2 Meeting

This is the typical method for most respondents to open discussions and spread important information. The meeting is usually held in either regular or random. There are two types of outline to call for a meeting. One is the traditional meeting through face-to-face approach in a conference room and the other is virtual meeting by teleconference with Sametime. Based on different roles in the project setup, the number of meeting attendance can be different. Most people agree that the meeting does help work but needs to adjust in an effective way. For instance, bringing more decisions and decreasing helpless discussions in the meeting that will improve work efficiency. Some respondents mentioned that if you leave time for engineers to
focus on solving problems individually, the benefit would be more beyond asking them to attend meetings. As for the meeting organizer, respondents argued meeting could have organized in an appropriate way. For instance, a good meeting setup is expected to have reasonable schedule with related participants. However, the meeting might be a way to receive new task so some people tend to avoid unimportant meetings.

4.2.3 Email
Email has its advantages to deliver messages without time zone and location consideration. Most people believe email help their work particular engineers. However, it is also has some drawbacks. For instance, email cannot support real-time conversation and the content is unstructured to find information. The forward email usually contains inappropriate copies from people, which has made communication performance even worst. For engineers, they usually spend more time in the laboratory rather than sit in front of the computer so the frequency of check email is low. One respondent complained email explosion brought problems to manage his work. Some people believe many emails are like spam and potential risks are easy to hide behind the email. On the whole, email is not an ideal tool to address a complicated discussion.

4.2.4 Face-to-face
Although everyone agrees face-to-face is the best way for communication activity, transnational collaboration may not adopt this into each task. Without a doubt, face-to-face can open connection by seeing and talking to people. For example, a workshop in early project phase is an occasion to approach people physically. Throughout the workshop, a significant influence would bring to collaboration because people know who to contact. Additionally, face-to-face communication aids clarify problems easily and people see reaction and receive responses immediately. The necessarily of sending people to have face-to-face discussions is something hardly to ignore because working together for short period has brought a significant progress in both professional skills and friendship.

4.2.5 Phone
Many respondents claimed that phone is used for emergency or reminder needs. But most Canadian dislike using phone to communicate with people. In some cases, phone can be a reminder after sending out emails. If people want to have a quick answer, calling on the phone will be the option. Although oral description by phone can illustrate a proper context to each other, one demerit is that the historic conversation is hard to recall the memory. One respondent shared an experience is that a complicated issue is impossible to receive the answer just through one single phone call.

4.3 Existing problem list
According to the inventory within three countries, the existing problem list is identified below.
I will start analyzing and explain the causes of each problem in the next chapter.
1. Poor interaction between different sites.
2. Overuse communication tools.
3. Different interpretation.
4. Time zone concern.
5. No trust between sites.
6. Unfamiliar relation between sites.
7. Manually handle material.
8. Late design changes.
9. Tricky time plan.
5. The roles of transnational interactions in IT development

Apart from literature review, one inspiration is from an early age slogan (see figure4) in fieldwork. It said the truth that “people” is rather important than technology in collaboration. Certainly, technological feasibility is made by human’s demands. This aspect inspires vision and become a central standpoint to reflect on the impact of transnational collaboration within IT development.

![Image](image.png)

*Figure4: inspiration from an old slogan.*

5.1 Exploration of existing problems

Within this case study, the more I have approached the more existing problems are found among interruptions and communication behaviors during work activities particularly in transnational collaboration. However, one positive thing is that serious communication conflicts do not find in same location. Thus, preliminary research scope has formed within transnational collaboration only. First, an analysis of interruptions is illustrated below.

5.1.1 Interruptions

The major interruption in collaboration is the highly request for acknowledgment between different sites and the actual context is too complex to control communication interaction. Another cause is the subjective interpretation from individuals, which results in different consequences. Based on one research finding from Harr & Kaptelinin (2007), interruption will draw a picture of interaction problems. A glance at two aspects of interruptions is exposited following.

● Working model:

Regarding to manpower allocation from project R11, most people worked partly (around 15%-20%) which is perceivably in priority management. If one site has overloaded tasks, the other site would never receive reasonable support or response. Furthermore, unclear goals between sites in early project phase make people confused to place themselves into the correct position. More specifically, this may interrupt the work progress due to unfamiliar collaboration relationship.

On the other hand, project R12 has highly attention as core strategy so that employees are not frustrating to confront challenges although interruptions occur. In addition, information transparency in project R12 is more apparently compared with project R11. The most important factor in project R12 is everybody locates in the same building; therefore, relationship is stable and closer.
Social factors:
Based on ripple effects (Harr & Kaptelinin, 2007), I took project R11 as an example to describe the interaction in teamwork, a general interruption (see Figure 5) between the interrupter and the service provider (interrupter and service provider are coworkers from different sites). When action A triggered action B, chosen strategy was determined by historical relation and available options. Either consequence in request activity could be possible to solve out or keep holding this interruption. Until the resources were unfreezing, the service provider could offer best solutions to the interrupter.

![Figure 5: interruption diagram within distance collaboration.](image)

By seeing the outcome of interruptions, sometimes irrational cooperative strategy is shown. Apparently, social aspect is strongly influenced people’s behaviors. One preliminary analysis of social elements is demonstrated.

1. Friendship: it has been tough to win recognition from site to site in the beginning. In particular, being remote side is always lack of certainly response and hard to reach people from the main site because of different interpretations. Once the friendship has been concreted, communication flow would be clear between each other.

2. Culture: different culture represents different working attitudes. For instance, eastern society is not as open as western society in general. The consequences based on cultural difference result in diversity of interpretations, which affect work performance significantly.

3. Self-capability: most interrupters are junior and lack of capability to access resources in the workplace. Regarding to figure 5, interrupters have to wait until service provider reply answers back. In other words, the capability from service provider also determines to affect work procedure.

5.1.2 Communication behaviors
Apart from the interruptions, communication behavior was also directly linked to existing problems, which influenced teamwork significantly. An overview working experience has
already described in the previous chapter that communication process can be divided to three phases: (1) Input (2) Behavior (3) Output. Regarding to my survey, both input and output were displayed a fixed result whereas behavior could be hard to project within communication activity. Regarding to empirical inventory, most respondents agreed that language was only a minor barrier during communication activity because written usually could make up the gap. One key factor to cause communication problems was cultural difference. The representation was apparently affected to perspectives such as working attitudes, working patterns and working habits. For instance, people with different backgrounds have different opinions of seeing urgency. “We might ask for something that we regard us very important but according to their experience and culture that is not important,” one interviewee said. Simply to check out performance of issue handling from site to site, the ways of handling tasks normally was depended on cultural background to receive different consequences.

Again, the outlook of communication behaviors could be found through work activities. A discussion was illustrated into four categories in order to evaluate current communication behaviors in field.

- **Culture:**
  A hierarchical organization is not a matter in Sweden. Swedish respondents expressed casual stylish attitudes and equalitarianism in society has influenced behaviors directly in both work and social life. The evidence shows coworkers from western society are more proactive participation during group discussions compared with employees from Eastern. In Asia, due to highly pressure working environment and result oriented policy, most employees usually work longer hours in order to reach the commitments. However, one potential risk in the Eastern site is that unstable employment relationship has caused a lot of communication cost because most young engineers tend to change positions approximately once a year. One interviewee described the situation – “a new guy had understood how to work after 4–6 months but one year later he changes his job!” This repeating cycle would take a lot of efforts from many senior employees to maintain the collaboration process. Regarding to the working attitudes and working habits from Table3 in section4.1, most respondents from Canada and China gave a comment that social life in Sweden is important than work. Although everybody appreciated favors from site to site, communication experience with Sweden is just OK (not yet to reach “good level”). As for Canada, due to time zone concern and newly merged (about only two years), most respondents mention learning activity is still ongoing to adapt themselves to work together with others. One good practice is found that by sending people to work together on-site for a short-term assignment is given a significant progress to further communication. “A week spend and visiting, talking face-to-face and meeting people was worth three month chasing around” from one of interviewees.

- **Working environment:**
  Roughly to review working context, office infrastructure brings effects upon the communication behaviors because each reaction is based on its unique office infrastructure from country to country. For instance, one respondent complained about poor quality of phone system in Canada. He said “Everybody tends to use the phone in the meeting room because that is the only thing which is hardly failed.” Another concern is related to office layout. Let me take open office space as an example, this open structure layout made conversation
difficulty on seats because the sound could travel far away easily. Consequently, talking by desk phone will absolutely disturb people nearby.

- **Geographical location:**
  The evidence has shown that when it came to request handling between sites, most respondents have bad experiences to not getting fully attentions unless the request belongs to top priority. Furthermore, due to time zone issue, communication methods are restricted which is a main communication barrier nowadays. For example, employees between Canada and China are unable to have real-time conversation unless either site has to stay longer for waiting another. The outcome of analysis here is corroborated previous research (Bradner & Mark, 2002; Olson & Olson, 2000).

- **Position:**
  The impact of individual responsibility in communication process brings various conflicts. As higher position managers, a comprehensive mind to handle our project is needed. However, if the work loading is too high, they probably might not be able to suggest objective opinions. As for the bottom level of employees particularly in junior position, ability to navigate resources from other site during project development is needed to develop in a well-structure way instead of taught in random needs. To see another dimension from design to factory, as for New Product Introduction (NPI) project development, people are still looking for an appropriate working method to handle collaboration.

**5.1.3 Finding in existing problem list**

According to the investigation of existing problems, many evidences have proved that the collaboration mechanisms are determined inappropriately. The problem list has showed a fact that a big gap between what we would need to do socially and what we could do technically is nicely demonstrated in a table (see table 7).

Consideration of addressing top priority as a whole, misunderstanding between transnational sites has become the most critical concern in cooperation due to heavy work loading and unfamiliar friendship. Next, improper using communication tools and different culture backgrounds make different interpretation to deal with collaboration concerns. Because of time difference, some people are lack of real-time response. Nevertheless, rapidly change and unfamiliar relation brings tensions to collaboration. Again, these problems above have to deal with soft-related consideration (Hyypiä & Pekkola, 2011) socially and globally.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Poor interaction between sites</td>
<td>Heavy loading &amp; unfamiliar friendship</td>
</tr>
<tr>
<td>2. Overuse communication tools</td>
<td>Incorrect methodology to use tools</td>
</tr>
<tr>
<td>3. Different interpretation</td>
<td>Different conditions in tasks</td>
</tr>
<tr>
<td>4. Time zone concern</td>
<td>Real-time support is needed</td>
</tr>
<tr>
<td>5. No trust between sites</td>
<td>Hidden potential problems</td>
</tr>
<tr>
<td>6. Unfamiliar relation between sites</td>
<td>Cultural difference</td>
</tr>
<tr>
<td>7. Manually handle material</td>
<td>No proper tool</td>
</tr>
<tr>
<td>8. Late design changes</td>
<td>No clear collaborative policy</td>
</tr>
<tr>
<td>9. Tricky time plan</td>
<td>Compromise with market demand</td>
</tr>
</tbody>
</table>

*Table 7: an analytic critical problem list.*
6. Reflection and design suggestions

This study declares transnational interactions in contemporary IT development have been changed the way how employees work together. These interactions are between people, culture, working context, communication and collaboration mechanisms (see figure 6). Consideration of these insights, design suggestions have confirmed to approach social considerations. “People” plays a vital role because many soft-related matters affect the outcome of interactions (Hyypiä & Pekkola, 2011; Nelson & Stolterman, 2003). Certainly, different backgrounds represent different culture so it would be a key to access the door between countries if staff understands culture. Based on the perception of culture, a clear communication layout will improve working performance. A clear communication means an understandable way of conversation or information is delivered from place to place. On the other hand, engineering culture shows a lack of service relationship in field study just because everybody has too straight focus on their areas. However, engineering culture is not totally negative to the workplace. Instead, developing professional skills is as important as interpersonal skills. Therefore, one approach to shape engineering culture is proposed to build up a learning design thinking organization can be considered (Friedland & Yamauchi, 2011).

Based on the conducting study, the more complexity shows in field the more pressure has increased that changes people behave differently (Janlert & Stolterman, 2008). The results indicate that the complexity of transnational collaboration contains not only cutting-edge technologies but also social-minded issues. Thus, the necessarily of understanding how to employ complexity in the design suggestions is required. As long as people have the ability to handle complexity, transnational collaboration can encourage more creative value to IT development. The design attitude can be new alternatives to give the skills, time, and resources to further help in engineering field and inspire more employees to develop design thinking awareness (Boland & Collopy, 2004). Due to the results from related research and fieldwork, the design suggestions are stressed two focuses – short-term goal and long-term goal.

6.1 Short-term goal

Building the belief in teams and arranging policy between different countries opens an understandable opportunity to gather employees in the same working concept. When the awareness is created in teams, communication interfaces for accessing resources is needed to
define. Based on three types of demand form Appendix B, this practice is expected to solve barriers and improve current ways of collaboration. The detail description is followed.

6.1.1 Building the belief

Building the belief is an activity to combine associated resources and characteristics of the transnational society to develop a new relationship in global teams. Credibility is the core to formulize individual’s behaviors; therefore, when the trouble comes, people always have plans to react (Kimbell & Seidel, 2008; Cook et al., 2002). In order to establish a closer relation between global teams, communication strategy is developed, a guideline to direct operations and bridge teams together. The findings show communication strategy is needed to be the first reform so that both team leaders and team members understands how to response and follow (White et al., 2010). The team leadership is also important to encourage group of individuals in collaboration. This is a force to drive interactions in both organization management and product innovation. Based on the results of case study, a preliminary communication strategy has been identified in terms of communication roles, communication content and communication principles.

**Communication roles**

In transnational collaboration, three roles are required in communication activity. (1) communication lead: main responsibility is to define which data belongs to value information. (2) team member: global teams are involved in transnational collaboration. (3) communication designer: main responsibility is to mediate between communication lead and team member, and enable an effective communication environment.

**Communication content**

Each project is needed to illustrate its own communication format in order to control information flow. Therefore, it is essential to extract key value information (both oral and written) from current communication data (Sassen, 2002). The key value information is a meaningful description, which helps conversation become more understandable (Information would be relevant and transparent rather than spam) whereas simple information has no needs to record.

**Communication principles**

Strategy is a matter of principle to motive employees and guide leads to work on correct communication paths (Heath & Heath, 2010). Building up general awareness and setting rules could share same communication experience and eliminate gaps. In addition, a design attitude is also needed to add for creating an understandable atmosphere (Boland & Collopy, 2004).

As for generic policy, setting up conditions could clear ways of working between sites.

1. Core principles:
   - Making it mandatory with positive guidance.
   - More personal vision.
   - Keep respecting people.
   - Being truthful to each other.
   - Referring to good communication experience and inspire the rest of people.

2. Collaboration mechanisms:
   - Always giving explanations why this is needed.
   - Both positive and negative information are necessary to include.
All impacts and consequences should determine in advance and take into account.
Definition of rating in high, medium and low.
Systematically alert is needed.
Giving workshop would be a start to educate team members.

3. Practical manners:
   - Meeting
     1. The chairman is responsible for coordinating the meeting agenda and facilitating environmental setup and confirmation.
     2. Formal meeting should always accompany by an agenda but informal meeting should memo to project portal.
     3. The meeting minutes should be easy to share.
   - Project portal: this is a proposed web application made by SharePoint where provides coordination functions to save communication content and increase work efficiency.
     1. Worthy communication (key value information) would be managed here.
     2. This platform should support building global workplace.
     3. Global project organization setup and contact information could be clear to investigate and maintain.
     4. Meeting minutes should be stored here.
     5. Project notice would announce here.

6.1.2 Transparent segment
The concept of transparent segment is a capability for people to obtain cooperative knowledge. For instance, who to connect, how to interact in teams and what to bring into the learning organization is necessary to make it clear to understand (Ford & Voyer, 2000). To extend this idea, project portal is the IT solution that I want to bring in. It allows creating team profile building; meanwhile, opening a transparent space to share knowledge and tracing project progress and critical requests in one space only. The purpose of making preliminary templates is to bring everyone in field study works on the same vision by using the common communication tools.

<table>
<thead>
<tr>
<th>Email</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Notice &amp; personal use only</td>
</tr>
</tbody>
</table>
| Expected result | 1. Decreasing the number of emails  
2. No complicated group discussions. |
| Template | Title: [(High,Medium,Low)/(Info.,Action)]within 20 words with a significant purpose  
Content:  
1. Notice: you describe the [contexts] and state [needs] within bullet points. If needs, please add [time, place, documents and reference links].  
2. Personal use: simple conversations between two people or information delivery. |
| Frequency | Twice a day at least |
Table 8: An example of Email format.

<table>
<thead>
<tr>
<th>Meeting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Discussions for decision-making, problem-solving and team meeting</td>
</tr>
</tbody>
</table>
| Expected result | 1. Well organized meetings: people, time and Meeting minutes.  
2. Bring more decisions. |
| Template | Meeting agenda and Meeting minutes are needed to work later on. |
| Frequency | Generic technical meeting: basically weekly but sometimes could be once every two weeks.  
Team meeting: monthly  
Leads meeting: weekly  
Radom meeting: by calls |

Table 9: An example of meeting format.

<table>
<thead>
<tr>
<th>Project portal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>A meaningful information pool</td>
</tr>
</tbody>
</table>
| Expected result | 1. Only one entrance to access project information.  
2. Global view in one place.  
3. Increasing transparency of communication.  
4. Action point management.  
5. Decision log.  
6. Administrative log.  
7. Meeting minutes management.  
8. Project related information sharing. |
| Template | EPP site and Ericoll functionality |
| Frequency | Depending on needs |

Table 10: An example of project portal format.

<table>
<thead>
<tr>
<th>Phone &amp; face-to-face</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Quick answers</td>
</tr>
<tr>
<td>Expected result</td>
<td>Direct oral communication</td>
</tr>
<tr>
<td>Template</td>
<td>No specific forms</td>
</tr>
<tr>
<td>Frequency</td>
<td>Depending on needs</td>
</tr>
</tbody>
</table>

Table 11: An example format for phone and face-to-face.

6.2 Long-term goal

Previous research in engineering culture has already pointed out that engineer’s mindset is hardly to make a big switch in a short period (Leonardi, 2003). There are evidences that the consequence of education has been continued affecting individuals from academic
environment to the workplace (Leonardi et al., 2005). Through related research and these results from field it can be stressed a possibility in education that the importance of developing engineering student’s interpersonal skills. This suggested change is encouraged education to strength engineering student’s social skills by lectures and group work to evolve students’ mindset in order to confront future challenges. Education is the foundation to form knowledge and life presenting a power to shape ideas for individual. To improve a lack of social skills, a thoughtful design thinking culture also suggests includes into lectures to lead students experience and learn how the process has been completed (Friedland & Yamauchi, 2011; Nelson & Stolterman, 2003). Based on these two concepts to elaborate lectures for engineering students, in the future, there might be an innovative working concept generated by these students who have not only the scientific spirits but also social-minded oriented to confront collaboration challenges. If the long-term goal can be achieved, more creative ideas can be inspired by having more interactions between people, culture and technology.
7. Conclusion

The purpose of this study is to investigate how transnational collaboration has changed contemporary IT development. Over the decades, the growing IT development has started to face the difficulty of understandable organizational form. Most knowledge workers in transnational collaboration desire a capable context to be efficient and responsive where enables the transfer of knowledge across locations (Boudreau et al., 1998). As for contemporary environment, individuals cannot accomplish transnational challenges on their own without involving acknowledgement from others. Thus, the importance of considering global aspects in IT development is essential for both local and global organizations (Wyche, 2011). In order to answer the research question, I have conducted case study research method to vision the condition of transnational interactions in IT development processes with a telecom company. Despite the fact that many solutions are invented to solve transnational collaboration problems, the results of this study demonstrated the distinction between unchangeable law and collaboration mechanisms in IT development processes has not yet become greatly clear; therefore, communication barriers are occurred between people (Friedland & Yamauchi, 2011).

The difficulties transnational collaboration in the empirical study is mostly from the interruptions and the communication behaviors. Interruptions, are dynamic and unpredictable, cannot avoid occurring (Harr & Kaptelinin, 2007). Based on the findings, physical approach between individuals and setting up transnational collaboration mechanisms aid reduce the number of interruptions significantly. This filed study is proofed that the capability to manage transnational interactions has become smoothly after meeting up people in person. Moreover, the gap between people reflects directly upon communication behaviors and mostly misunderstanding is because of remote distributed collaborations (Olson & Olson, 2000). Although CSCW field has proposed a great deal of practice to eliminate transnational problems, the social-technical gap does appear between people and artifacts (Ackerman, 2000). If the social-technical gap can be addressed appropriately, distance might be no longer matter on transnational collaboration. When communication behaviors have become more understandable, many social-related matters in dealing with transnational challenges can be handled (Hyypiä & Pekkola, 2011). One of the consequences in communication behaviors is affected by culture. Engineering culture, in this study, is deeply embedded in collaboration where most people are lack of interpersonal skills to perform transnational communication (Keisler et al., 1985). This kind of occupational culture influences individuals and organizations particularly in technical profession, which creating cutting-edge value is normally fundamental rather than developing soft skills (Leonardi et al., 2005). Indeed, previous research demonstrated that communication performance in engineering culture does influence collaboration and the finding confirmed this type of working attitude somehow is needed to adjust (Leonardi, 2003). Based on the findings of the conducted study, transnational collaboration requires more involvement. Not only finding the right answers but also giving more attention on social-related considerations is needed for everyone particular in engineers. One aspect might be useful to reform engineering culture is to adopt design attitude to address transnational problems that may result in positive outcomes of transnational collaboration (Boland & Collopy, 2004). This paper has raised a new topic which transnational
collaboration is complex (Janlert & Stolterman, 2008) and only few discussions consider this as a critical issue. Although transnational HCI shows a new approach to overlook IT development, the finding is more focused on how to share experience and construct IT development in developing country (Wyche, 2011). As for this study, transnational HCI is partly relevant only.

Based on the related research and investigation in field, the design proposal is divided into two perspectives: the short-term goal to manipulate transnational interactions in order to overcome communication barriers and the long-term goal to suggest new perspectives: social-minded and design thinking into engineering education. To build up a not-yet-existing cycle is the short-term goal (Nelson & Stolterman, 2003), which communication processes are designed in terms social considerations including reliable friendship, common ground and understanding transnational collaboration. To “design” something for transnational collaboration, cannot adapt same technique as creating technical artefacts; on the contrast, reflexive understanding of the rules is vital to frame in each activity (Friedland & Yamauchi, 2011). Having the belief enables ability to access different interfaces of collaboration, which aids shorten the social-technical gap by learning design thinking and facilitating cultural change. In addition, by introducing technology can construct transparency collaboration. On the other hand, for the long-term goal, to revise engineering culture is the focus attempt from task oriented behaviour to social-minded attitude. Scholars stated an illustration of a dialectical relationship between work styles and culture, which work-culture was needed to emphasize increasing the value of teamwork and collaboration (Leonardi et al., 2005). A new thought in engineering culture may switch behaviors and attitudes in collaboration are to change the theme of education. The new theme for education is formed a social minded to students by lectures and practice. Using lectures is to give basic knowledge to students gaining understanding of collaboration. Based on this, group work for students is an opportunity to practice how to apply into contexts. This is an ideal preparation to enter the workplace for students. Meanwhile, there is a new awareness – design thinking culture which engineering culture is needed to take into account. Globalization is a potential concern to the collaboration. It performs both negative and positive influence by culture and working contexts. Without a doubt, transnational collaboration is definitely needed to develop a comprehensive perspective within teamwork and education.
Acknowledgements

This paper could not have been written without the helpful people from Ericsson and Umeå University. First, I am grateful for the generous of assistance and suggestions from Ericsson, which I will outline below. Second, for Umeå University, I am indebted to my former supervisor Anna Croon Fors has been the most influential and Torbjörn Nordström for the valuable input. Finally, I would like to express my gratitude to receive constructive criticism by several intelligent and creative readers, Patrik Björnfot and Emma Zhou.

- **Data collection in fieldwork:**
  - Organization unit: Radio Design
    - Participation:
      - Sweden: Kista, Kumla, Lindholmen
      - China: Beijing, Nanjing
      - Canada: Ottawa
  - Organization unit: Enclosure & Power
    - Participation:
      - Sweden: Kista, Kumla, Lindholmen

**Advisers:**
HW design Project Office: Ingemar Sohlman, Susanne Nyström
References


Appendix A: Interview questionnaire

1. What is your role in the project?
2. What is your main responsibility?
3. Can you explain your tasks?
4. In order to achieve your tasks,
   i. Which group of people (domestic or overseas) that you have to cooperate with?
   ii. Why did you have to approach them?
   iii. How did you communicate with them?
5. Please express your opinions of using particular communication tool in your work within particularly contexts. Also, please explain its advantages and disadvantages.
6. Could you tell me which group of people has the most strong interaction with you? Please describe the motivation of communication and the ways of communication in detail.
7. Please share your experience of using different communication tools (specification of contexts).
8. Does communication bring transparent information in your work? If so, could you please tell me the consequences of communication? If not, what was the primary factor to lack your work? Do you have any suggestions to improve current ways of communication?
9. Could you reflect your domestic and overseas communication?
10. Do you work on HW scrum project? If so, please share your experience and compare with the traditional ways of working. Please state its merits and demerits.
Appendix B: Personas and Scenarios

B.1 Case1: Canada

“Running around the cycles is a time-waster!”

Daniel Smith, 38
Verification Object Leader
Ottawa, Canada

- Focus on technical field.
- Personal preference of communication method:
  - Email, IM & face-to-face
- International collaborative communication
  - KI: primary by email. Sametime-meeting and business trip by request.
  - KL: email, regular Sametime-meeting.
  - CBC: primary email.
- Current concerns
  - Time difference: restricted communication methods.
  - Transnational collaboration: unreasonable attention.

<table>
<thead>
<tr>
<th>Experience goal</th>
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<tbody>
<tr>
<td>- Integration into new culture</td>
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<td>- Better setup for collaboration</td>
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<table>
<thead>
<tr>
<th>End goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Available to reach expertise</td>
</tr>
<tr>
<td>- Efficient collaboration</td>
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</tbody>
</table>

Scenario
Due to a failure of configuration, Daniel wants to request help from Sweden. He simply follows the communication plan and initiates the request through project portal in order to keep all information in one place. And then, teleconference meeting is arranged by him to discuss for problem-solving. He said: “Here I found information is more transparent and reliable.” Now, project portal offers a convenient way to share experience.
**B.2 Case2: China**

“I am struggling to create an open atmosphere to inspire my core team.”

David Wang, 29
FRAG Leader
Nanjing, China

- Personal preference of communication method:
  - Meeting & Phone
- Working more than 10 hours a day.
- Work could be top priority in his life.
- Cooperation relationship
  - Design team: CBC, KI
  - Suppliers
  - Production transformation: KL
- Work scope
  - Design: leave comments
  - Prototype: capability for assembly
  - Release: complete products
  - Maintenance: after-sales service

<table>
<thead>
<tr>
<th>Experience goal</th>
<th>End goal</th>
</tr>
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<tbody>
<tr>
<td>- Low cost for volume production</td>
<td>- Secure design within prototype</td>
</tr>
<tr>
<td>- Easy to maintain</td>
<td>- Evaluate supplier’s qualification</td>
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</tbody>
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### Scenario

David always encourages newly joined employees to express their opinions in meetings and individual reviews. His principle of teamwork building is to create positive working attitudes in transnational collaboration. The open discussion is one of means to formulize a cordial atmosphere. This helps problem-solving and risks are represented in advance. This inspiration allows his core team to participate in refining communication plan. However, another concern is to find out a balance working model in transnational collaboration.
B.3 Case3: Sweden

“I meet new people each year in China.” & “I only attend relevant meetings.”

- Personal preference of communication method:
  - Phone
- Regular working hour from 8 AM to 4 PM.
- 20 years working experience.
- Responsibilities
  - Complete design on time
  - Secure supplier’s quality
  - Consulting support for junior engineers
- Current concerns
  - The meeting is just take people away from work.
  - Due to cultural difference, transnational collaboration is difficult to balance.

Jack Eriksson, 46
Senior mechanical designer

<table>
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<tr>
<th>Experience goal</th>
<th>End goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>- More understanding between sites</td>
<td>- Flexible meeting with relevant information</td>
</tr>
<tr>
<td>- Efficient information sharing</td>
<td></td>
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</tbody>
</table>

**Scenario**

Jack usually visits China once a year for short-term assignments. It is tough to maintain collaboration relationship because most young engineers do not work in the same positions for a longer period. A transnational training system is necessary to establish project related knowledge such as working methods and professional. As for new employees, clear information aids task activities work efficiently. The communication plan has been improved transnational collaboration significantly and expertise has more time to concentrate on design. “This is what we want to do with communication, Jack said.”