

Understanding Structures and Affordances of Extended Teams in Global Software Development

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Abstract—Growing popularity of Global Software Development (GSD) has resulted in an increasing number of cross-organizational teams that are formed according to Extended Team Model (ETM). There is little known about the structures (work, social, and communication) that may exist in ETM and what affordances those structures provide to support collaboration and coordination. This paper reports a case study that has studied the structures of an ETM in GSD and how those structures provide affordances for dealing with known GSD challenges. This study has revealed that whilst the current structures in the studied team help deal with different GSD challenges, these structures appear to have certain challenges inherent in them and the affordances they provide. We make a few recommendations for improving the current structures to deal with the observed challenges. Our findings are expected to provide insights into the types of structures and associated challenges for implementing ETM in GSD.

Index Terms— Global Software Engineering; structures; affordances; case study.

I. INTRODUCTION

Global Software Development (GSD) has become a popular paradigm of developing software with teams that are expected to be affected by distribution factors (such as temporal, geographically, socio-cultural, knowledge, and processes). Organizations adopt GSD through various models such as outsourcing, offshore development centers, global sourcing, and virtual teams [19]. An increasing number of organizations have been moving from outsourcing mode of GSD to collaborative form where they enter into long term partnerships through which they extend their onshore software development teams with the software development resources provided by a vendor, usually located offshore. Such cross-organizational teams are considered to follow a so-called Extended Team Model (ETM) [20], which is increasingly become popular model of forming collaborative partnerships with software development vendors rather than outsourcing model.

The ETM is especially suitable to the circumstances of Small-to-Medium Sized Enterprises (SMEs) that usually have limited resources for outsourcing governance and fluctuating demand for developing software to support their business processes. This model is similar to virtual teams [17] but has several subtle but important differences. There is little known about the kinds of structures (such as work, social, and communication) that may be required for ETM

and how these structures contribute to and/or to help address the known GSD challenges. Researchers have been highlighting the importance of understanding and supporting appropriate structures (i.e., work, communication, and social) in software development [3, 15, 24]. Hinds and McGrath have also reported that appropriate structures can help ease coordination challenges in geographically distributed teams [10]. Hence, it is important to increase our understanding of the structures and their appropriateness for enabling ETM to address GSD challenges. We assert that suitably designed structures can afford ways and means of addressing the challenges caused by distribution factors (such as geographical, temporal, cultural, and organizational). It is also important to understand the GSD challenges that may not be fully addressed and/or may have been caused by certain types of structures being used by ETM in GSD.

This paper reports a case study aimed at empirically studying the work, communication and social structures implemented by a cross-organizational ETM to identify and understand their attributes and the affordances provided by them to support collaboration and coordination and address GSD challenges. Our findings show that supporting the interdependent work structure through dens communication and social structures can afford several means of building the feeling of togetherness and high level of trust, making it easy to initiate conversations, establishing common understandings and maintaining task and team awareness. However, the studied structures do not help deal with the difficulties caused by delayed feedback, communication gap, and requirements problems.

II. RESEARCH FRAMEWORK

We introduce the concepts that have provided a framework for the reported research. These concepts have been used in guiding our research design, data collection efforts, analysis approach, and interpretation of the finding.

A. Extended Team Model(ETM)

We define Extended Team Model (ETM) in GSD as a customized offshore outsourcing model. An ETM can be characterized as an extended arm of a client to have continuous access to software development infrastructure (i.e., staff, technologies, and processes) of a vendor, usually located offshore [20], [22]. The ETM is similar to virtual teams [17], however, there are several subtle but important

differences, for example, unlike virtual teams, the life of a team based on ETM lasts beyond a single project or even a program consisting of several dozens of projects. The staff from a vendor side is tightly integrated in a client's team with access to technical training and mentoring from the client's staff. An ETM also provide a client with high visibility into and more control on the status of a project.

B. Structures

The term structure refers to a framework of identifiable entities and relationships among them, also called the elements of a structure. There can be several kinds of structures in software development teams such as communication structures [3], social structures [24], and organizational structures [15]. It has been shown that the interplay among work, communication and social structures can influence effective coordination of work of geographically distributed teams [10]. This work is mainly focused on three types of structures: work, social, and communication. In the following sub-sections, we briefly explain each of them in order to help understand their role in GSD teams for providing affordances to support collaboration and coordination and the importance of their interplay for addressing GSD challenges.

Work structure represents the flow of work between team members that means work structure outlines interdependencies among different activities, tasks, and people. A highly dense work structure (i.e., too many interdependencies) is expected to require a huge amount of coordination effort. An organic work structure with highly interdependent tasks can provide a suitable infrastructure for sharing project knowledge, however, this kind of work structure may need frequent communication for supporting increased volume of collaboration. The work structures that make appropriate use of formal and informal hierarchies can support work coordination by centralizing the information and efficiency of communication, though it should not introduce additional barriers to seek information [10].

In the context of GSD, loosely coupled tasks are expected to minimize the need of frequent interactions among members of a team. A work structure based on loose-coupling can be costly as a result of enormous cost of resolving integration difficulties and mismatches that can happen due to information masking, poor information sharing, and sticking of project knowledge to specific locations. We argue that it is important that the organization involved in GSD project have appropriate work structure that afford means to deal with GSD challenges.

Social structure represents the formal or informal social networks (i.e., ties and interactions among people) that may exist within a project or an organization. It is asserted that the existence of strong social networks can help people to better coordinate their work activities and share knowledge. When people know each other they are more likely to emotionally feel close to each other and can be more comfortable to share relevant information [10].

Strengthening social ties can develop the feeling of team-ness that is usually lacking among the individuals who work in geographically distributed teams. Whilst it is important that companies involved in GSD continuously work for bridging the social gap between remote colleagues by affording different types of opportunities and mechanisms to build new social ties, managers should also identify and leverage the existing social capitals when forming teams or new work structures.

Communication structure means a set up of formal and informal mechanisms and conventions to enable team members to communicate about work and personal matters. It has been reported that a thick communication structure can afford different opportunities for negotiation, clarification, and obtaining common understanding. Appropriate communication structure also helps increase awareness of work progress, build trust, and minimize the negative impact of physical distance. There is a significant interplay between work dependencies and communication networks. An organization needs to provide appropriate technological support for affording GSD teams opportunities and mechanisms to establish and maintain formal and informal communication networks.

C. Affordances

The word affordance comes from a psychologist's, J. J. Gibson, work on perceptual psychology [9]. Gibson's work resulted in the theory of affordances. According to Gibson, affordances are relationships that exist, visibly or invisibly, between the world and an actor. Donald A. Norman has differentiated between real and perceptual affordances and their role in Graphical User Interface Design [16]. The concept of affordances has been applied to many disciplines, particularly where the focus is on how humans interact with other humans or machines in order to perform a particular task such as Human Computer Interaction (HCI) and Computer Support Cooperative Work (CSCW). The concept of affordances has also been used in Software Engineering by Scacchi to study the collaborative affordances in Open Source Software development [21]. It has been claimed that well designed and effective computer supported work can afford different ways of social interactions for supporting collaboration and coordination in complex environments.

We are aware of several definitions of and theoretical debates on the concept of affordances. However, a discussion on them is not the focus of our research. Without further discussing the theoretical foundations of the concept of affordances, we describe how we have used the concept for studying the structures (i.e., work, social, and communication) that exist to support collaboration and coordination in an ETM. For this research, our operational definition of affordances has been derived from the work of Gibson and how it was introduced into product design by Norman including both perceptual and real affordances. Hence, we use the concept of affordances as *the relational properties between objects and actors in order to support interactions required to perform a particular task in a*

certain situation. Hence, our focus is on the affordances provided by the existing structures to support collaborative efforts of geographically distributed teams. We assert that well designed and effective structures (i.e., work, social, and communication) and associated technological support can provide appropriate perceived and real affordances to support the collaboration and coordination required by an ETM.

III. RESEARCH DESIGN

This study aimed at identifying and understanding the structures (i.e., work, social, and communication) of an implementation of an extended team model and how these structures can help to address or introduce GSD challenges. We assert that structures provide affordances, which can help to address GSD challenges. Each implementation of ETM is tailored to a particular context and organization. Hence, it is imperative to first understand what structures organizations have adopted to support an ETM in GSD. We were also interested in finding out what affordances had been provided by the implemented structures to address GSD challenges. After identifying the structures and the affordances, we were interested in identifying GSD challenges that may be associated with the mechanisms of the structures being used in the studied ETM.

RQ1: What are the structures (i.e., work, social, and communication) implemented for supporting a cross-organizational extended team model? And what affordances these structures provide to address GSD challenges?

RQ2: What are the challenges that have been introduced or not addressed by the implemented structures?

A. Research Method

The selection of research method should be based on the nature of research question and state-of-the-art in the studied problem [7]. There has been little empirical research on structures of extended team model and how they can help address or exacerbate GSD challenges by providing suitable affordances. We decided to use case study as our research method. Case study is considered a suitable research method to investigate a contemporary phenomenon within its real-life context [26]. Case studies can be descriptive, explanatory, exploratory or evaluatory [25]. Given the nature of our research, we conducted an exploratory case study that is used to uncover the “what” questions [26]. Apart from the case study guidelines provided by Yin [26], we also referred to the checklist provided by Kitchenham and colleagues [12]. The unit of analysis is a cross-organizational extended team consisting of team members from two organizations, which were client and vendor.

B. Context

We have carried out this case study with an ETM based software development team consisting of software development professional from two organizations that had been business partners as client and vendor for more than 3 years. The client is based in Denmark (DK) and the vendor

has a business development office in DK and a software development centre in Pakistan (PK). Figure 1 shows the organizational arrangements for the studied ETM. The two circles highlight the geographical locations of the involved parties. This Figure 1 also provides some details about the involved departments and key roles, and the boundaries of the studied Extended Team (ET).

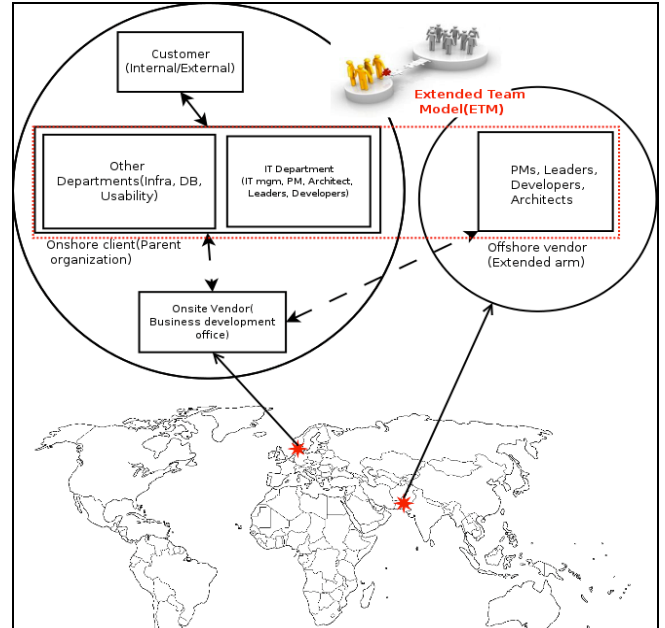


Figure 1-Organizational arrangement & ETM

The implemented ETM has a unified team including the client’s departments and the vendor’s offshore development team. It should be noted that the extended arm of the client at the offshore centre officially managed by the vendor. While different software development roles are assigned to the team members in DK (called onshore team members) and PK (called offshore team members), the offshore team members carry out a large majority of the implementation and maintenance related activities. The onshore team members are involved in all phases of software development, however, their activities are usually focused on requirement elicitation and clarifications as they can easily access to their customers located in Denmark - internal (i.e., business units of the client) or external who use their systems.

C. Data Collection

Our main data collection approach was semi-structured interviewing [14] that helps explore perceptions and experiences of practitioners and collect qualitative data. This report is based on the analysis of the data gathered through 12 in-depth interviews conducted with both offshore (7 out of 12) and onshore (5 out of 12) members of an extended team. The interviewees had diverse roles varying from developers, technical leaders, architects to project managers, process manager and IT manager. The average work experience of the interviewees was 9.5 years (minimum 5 years and maximum 13 years). The semi-structured interviews enabled

us to get involved in discussions with the interviewees while following the interview instruments and gather quite rich qualitative data. Each interview lasted around 60 minutes. The interviews were transcribed verbatim on 232 pages.

D. Data Analysis

We analyzed the data using the qualitative data analysis techniques inspired by grounded theory [4-5, 23] (Note: we are not claiming that we used grounding theory as a research method). We applied open coding for analytically breaking down the data and interpreting the phenomenon reflected within data. [5]. We also utilized the axial coding technique [5] to identify the relations between the identified categories. Based on our research questions, we decided to highlight work, communication and social aspects within the data. We identified the data fragments where interviewees had referred to any of these areas.

The selected data fragments were big chunks of data as the answer of an interviewee to direct questions such as: “How the work breakdown is done?” (i.e., related to work structure) as well as shorter scattered data fragments that resulted from getting involved in discussion with the interviewee as a promise of semi-structured interview such as “so, you think it’s related to something with the culture or what?” (i.e., related to social structure). We assigned emergent codes to the selected chunks of data associated with the key point of text. We kept the aspect of the selected data embedded in our coding format. For example, the codes starting with “comm.-” were referring to communication aspect. We also coded the reported challenges within the data and identified their relation with any of the aspects of our interest (e.g., work structure). We used this process to code all the transcriptions from the interviews.

Our understanding of the data improved over time. After finishing the first phase, we organized all the extracted data based on three aspects. For each set of the data, we looked through all the related codes and the key points to search for the potential themes. For example, “Flat communication pattern” over communication-related data set. In this process, we refined our codes iteratively and checked them against the themes. We performed the same process for synthesizing the identified challenges within the whole data and defined the themes. We also noted down the relations of the challenges with every aspect of the identified structures. We improved the relational codes based on the identified themes for communication, social and work structures.

Then we reviewed all the defined themes within the data for verification against the entire data. In order to identify the potential of each of the structures, we compared our findings with existing literature reporting well-known GSD challenges, in particular the ones described in the framework of threats and opportunities proposed by Agerfalk et al. [1]. This process helped us to relate the themes to the provided affordances to alleviate common GSD challenges such as reduced trust and lack of team-ness. Finally we related the identified themes back to the applied codes and to the research questions. This step resulted in minor refinements.

A. Work Structure

We present the findings related to the main attributes of the work structure implemented for the studied ETM.

1) Dynamicality

We found that the ETM was implemented in a way that introduced dynamicality in the work processes and task types in terms of diversity and multiplicity of projects that were being undertaken in parallel. The onshore software development site of the implemented ETM had several demands of either maintaining existing systems or developing new ones from internal as well as external customers. That was why there were several small as well as large projects being concurrently carried out by the software development teams on both sites. Hence, the tasks allocation had a strong tendency of being dynamic based on the urgency and availability of the staff who could perform the tasks based on the required knowledge and skill set.

Whilst the dynamicality appeared to be one of the salient attributes of the work structure implemented for the studied ETM, it had expected certain team members to work on multiple projects simultaneously and wear multiple hats. That means one particular artifacts (i.e., requirements specifications) may be prepared by different team members for different projects and it may result in huge variation in the quality of the structure and content of a particular type of artifact prepared by different team members.

2) Interdependent tasks

It is well known fact that distributing work tasks across different sites creates interdependencies. The interdependencies may be caused by a certain way of breaking down the work structure and the task allocation decisions. The interdependencies can increase as a result of changing requirements and bug fixing requests. Our study found that there was a large number of task interdependencies between two sites caused by the above-mentioned reasons. Moreover, there was no perception of competency gap between the offshore and the onshore sites. Hence, the work items (WI) were structured based on skill sets, availability of resources and needs of the required knowledge. One interviewee reported this practice:

“There are a lot of factors considered for task allocation...the skills and design, the workload and you know for example, how much consultancy you need...”(P9)

Whilst the studied ETM was not explicitly applying loose coupling strategies such as allocation of WI based on life-cycle phases, system architecture or complexity of the modules, the distribution factors usually influenced the way work for the certain software development phases were structured. For example, the tasks requiring business side consultancy and face-to-face interactions with customers had been allocated to onshore team members. That meant they were mainly responsible for gathering requirements from customer (internal and external ones), preparing initial specifications and sending them to the offshore team, which

was involved in analyzing requirements and devising and implementing potential solutions based on the specifications.

3) *Formal hierarchy but tolerance for informality*

We found that the ET had a formal hierarchy for coordinating the work interdependencies. A formal hierarchy can be characterized by the existence of different hierarchical work structure with different roles and responsibilities. We found that whilst different individual teams were acting under the leadership of a technical leader, a Senior Project Manager (SPM) at the offshore site was responsible for coordinating the activities between technical leads at both sites. We found that the leadership of the architecture group mainly acted based on a command and control strategy, the technical leaders mostly allocated tasks after consulting with developers. One developer from the offshore site described this practice in these words:

"Mainly our lead and us (developers) sit together and decide which resources are expected in which area; then when the resources are allocated to each chunk, each resource is responsible to make the breakdown structure. The big level picture is designed by our team lead but in extended mode we design by ourselves." (P7)

The work division was carried out under the shared supervision of two technical leaders, onshore and offshore. This practice appeared to have stemmed from the Danish way of decision-making that takes a consensus building approach despite having a strong sense of hierarchy. A similar practice found was having a culture of junior team members consulting with senior people before making critical decisions without considering their official role. The work structure had the provision of informality that appeared to have enabled team members to share knowledge and expertise at different levels of hierarchical structure that existed in the implemented ETM.

B. Communication Structure

For the communication structure, we identified three main attributes, which have been reported below.

1) *Flat and Frequent communication pattern*

We found that a highly interdependent nature of the work structure of ETM based GSD team required a high volume of communication among team members at both sites. The management had introduced a flat communication structure that means anyone can talk to anyone without any reluctance or hindrance. We also found a pattern of frequent and spontaneous initiation of communication by team members through Skype (Voice and Text chats) and emails to seek clarification and resolve issues.

Though a flat communication pattern is assumed to be suitable for sharing knowledge and increasing awareness and trust, it can also introduce inefficiency, overlapping discussions and more effort for control [10]. Our analysis revealed that the studied ET exhibited several signs of suffering from the flat communication's negative effects. In order to minimize the potential negative impact, a role of communication facilitator was introduced in the implemented communication structure. However, there were

also certain etiquettes for using the flat and impromptu communication provisions. One interviewee described:

"Typically we'll start with a voice chat, or rather with a text chat, and you can instantly find out whether or not a person has time at the moment, because I have to respect that the person can be working on something, unless it's something critical to the business [...] but what we do now is, we just ask. For example, I would say, 'hello ... do you have five minutes for me?' or 'do you have half an hour...?'" (P17)

Apart from supporting impromptu communication, the ET also had set up formal communication channels that were regularly used by the relevant staff members to share updates about the status of the work and any showstoppers. Some of the formal communication venues include Scrum meetings and updating burn down charts by developers on daily basis.

2) *Use of diverse communication media*

GSD teams usually use a diverse set of communication technologies. The communication structure implemented in the studied ET was also leveraging a diverse set of synchronous and asynchronous communication media. The team members were appeared to have quite good understanding about using different tools for different purposes. We found that Skype calls and IM were used quite frequently at team-level for impromptu quick chats for seeking clarifications and communicating urgent matters. Screen sharing was used for synchronous collaboration, e.g., code review. One interviewee described this situation:

"We mainly discuss issues through Skype calls and screen sharing with Team Viewer and normally if I have some specialized meeting then I will prefer to use video calls...it depends mostly on your roles." (P9)

It was found that asynchronous communication media were also used heavily. However, the emails were used as a formal way of providing elaborative answers and tracking the agreed decisions. A bug tracking system was also an important means of asynchronous communication.

3) *Communication facilitator*

We found that the existing communication structure had a designated role to facilitate the communication and overcome any miscommunications and misunderstandings. We also observed that some of the miscommunications might have been caused by the flat and impromptu communication practice. The communication facilitator was responsible for accelerating the response time and supporting the process of providing and clarifying the information needed by an individual. One interviewee described the function of this role in these words:

"I am supposed to be the facilitator...I have to make sure nobody is stuck if some information is missing...and I have to escalate things if needed...I would wait for few hours and then contact the person in another way...contacting somebody who is next to him to inform him." (P1)

C. Social Structure

We present the findings related to the main attributes of the social structure here.

1) Cooperative organizational culture

The complexities caused by different contexts (e.g., cultural and organizational) in which the members of an ET work need a high level of understanding and appreciation of each other's position and perspective. In order to proactively deal with the socio-technical complexities inherent in GSD projects involving multiple stakeholders, the management had introduced an "Equality Model (EM)" based on the egalitarianism commonly found in Scandinavia. The EM means that everyone in the team, irrespective of their geographical location and origin, feels equal. The EM also encourages individuals to openly talk with colleagues about culture, religion and hobbies while respecting each other. We found that the implemented EM afforded the team members equal opportunities to participate in discussions and decision-making by describing the solutions and sharing domain, contextual, and technical knowledge. As a result, the ET appeared to be able to avoid "blame game"; rather than pointing a single individual for a problem, the whole team takes the responsibility for a problem. This level of collaboration can be achieved through "Open eyes" and "Thinking out of box".

We found the introduction of EM proved a successful strategy to motivate team members to collaborate with each other. The feelings of being equal in the team on both sides brought the team members closer to each other and enabled them to initiate informal chats with peers by ping-pong on Skype, intimating about the vacations and time-off (e.g., paternity/maternity leaves, picking up kids from daycare), and respect each other's religious practices (e.g., a few hours time-off in the middle of the day for Friday prayer).

2) Leveraging pre-existing social ties

It is well known that setting up and nurturing social ties take time and effort. Hence, it is important to build a social structure by leveraging any preexisting social ties. We found that some of the senior managers of the ET had social ties that existed before the current client/vender relationship started. Those preexisting social ties were identified and leveraged for building and supporting the required social structure. The managers with the preexisting social ties were asked to proactively identify and discuss the problems and hidden information to address the frustrations at both sides and to enable the ET members to improve interpersonal relationships. One senior manager described this practice:

"I have a weekly or a bi-weekly meeting with [him]...just to address if there's any issues. Any frustrations say on the part of my team anything they've experienced on their end. if we talk anyways then there's always some information that hasn't filtered through to them or to us. It's always good to chat..." - (P16)

3) Individual-driven socialization initiatives

We found that one of the significant attributes of the existing social structure was socialization initiative at individual level for improving interpersonal relationships and dealing with socio-cultural challenges. We found a large majority of these initiatives were taken by onshore team members. It was a common perception that these types of

interactions could help create more relaxed environment to motivate their offshore colleagues to feel comfortable enough to point out problems and have critical but constructive discussions. Some of the onshore team members were of the view that sharing daily life activities and close interpersonal relationship could help the remote team members feel like colleagues rather than employees. One of the onshore managers described this perception:

"I don't think they want to disturb us, or... they have an idea that they're working for us, not collaborating with us. I try to...on everyday basis to involve them ..." - (P18)

We also found that these individual socialization initiatives were used for addressing interpersonal conflicts by sharing the cultural norms and customs to forge strong social ties. For example, we found that the discussions about the cultural perspectives and practices on females' role in IT industry helped team members on both sites to have a common understanding of the mandate of different roles held by females in the team in general but females at onshore site in particular.

D. Challenges

In the following paragraphs, we report the key challenges that the existing structures do not sufficiently address or may even exacerbate these challenges.

1) Communication gap

Like many other GSD teams, we also found that the studied ETM had a significant communication gap caused by the language and cultural differences, the knowledge distance, and the limitations of the available technological support. Communication gap has been identified as a challenge by several interviewees from both sides. Whilst the senior managers and technical leads reported the shortcomings of the communication media being used for providing the possibilities to share mind and draw diagrams during video conference, the developers were mainly concerned about the problems they were facing in understanding the requirements and what they were asked to do by the onshore team members. One interviewee said:

"Sometime there are communication gaps, we don't understand what they mean and they don't understand our concerns..." - (P7)

The working language appeared to be the main communication barrier as none of the team members was a native English speaker, however, English was the medium of communication. Though the level of proficiency in English appeared to be good on average at the offshore side, it seemed to be a challenge to fluently explain the ideas and associated solutions and put questions in an easily understandable format. On the onshore side, it seemed to be a similar scenario. The business people did not feel comfortable talking in English, hence, they preferred to have a middle-person who could translate their requirements which made it impossible for the developers to directly communicate with the customers for clarifications or resolving conflicts.

The knowledge distance also caused communication difficulties. The offshore team members did not have

sufficient domain knowledge and the customers were unfamiliar with the technical solutions. This situation required more communication for clarifications but it was not possible. Whilst the offshore team members complained about unclear and ambiguous requirements, the onshore team members reported the challenges of receiving the solutions that were not fit for their customers' needs.

2) *Problems in requirements engineering*

Several studies have reported different kinds of problems in requirements of GSD projects. We found that the members of the ET at both sites had problems with requirements gathering and specification activities and artifacts. One obvious reason for the requirements problems appeared to be variation in requirements gathering and specifications from one project to another without any standardized processes and artifacts. The offshore team members would be involved quite late in the requirements engineering process. Hence, they were facing significant difficulties in understanding the specifications because of ambiguities and unknown business terminologies.

We found that the onshore team members were aware of the challenges faced by their offshore teammates. However, they were unable to involve them in the requirements gathering process because of language differences.

3) *Delayed feedback and context switching*

We found that delayed feedback was one of the most frequently reported challenges by the offshore ET members. Whilst the offshore development team was satisfied with the level of availability of their onshore colleagues for getting quick response to their enquiries, they were experiencing extended delays in getting feedbacks when the required clarifications needed input from end-users.

We found that it was difficult for the onshore team members to quickly locate the needed information, which might belong to multiple stakeholders. Furthermore, there were limited resources at onshore to whom all the questions of developers from different projects were sent. Hence, the offshore team members got an impression that the non-emergency questions could be delayed, as their onshore colleagues were very busy. One developer stated:

"...Due to some hidden information our estimates don't work exactly like what we want [...] if we get delayed feedback it would disturb the plan for the next months and we have to do extra work and put extra effort to deliver according to the plan..." - (P7)

We found that the senior managers were trying to deal with the delayed feedback by allocating developers to multiple projects/tasks for optimizing the utilization of the available resources. This practice appeared to be a reasonable solution. However, this practice introduced another problem that we call "*Context Switching*." This type of switching between tasks is considered quite challenging in terms of difficulties in concentration. One developed stated:

"...It is very de-motivating when you start a project and you know you cannot finish it up because the requirements are not there [...] and yes it is hard to focus, switching from a project that you were in the middle of coding and getting

stuck in something that you need to know and you know you would not get the reply at least until tomorrow..." - (P8)

4) *Socio-cultural issues*

The continuous effort to build social ties to improve the feeling of team-ness appeared to be an effective strategy to deal with the main issues caused by the social-cultural distance. We found that the employees were encouraged to talk about non-work related matters (i.e., also called "cheap talk") to learn about each others' religious beliefs, respect each others' dressing codes, and culture. It was perceived by the offshore side team members that there was not much known about their culture and life style.

The onshore team members were interested in knowing the cultural norms of the offshore team members. They felt that they were open to share knowledge and hear about the problems but their offshore teammates were usually quite reserved. They also attributed the tendencies of "not saying No", "over committing", and "not thinking out of the box" among offshore team members to their cultural training. We found that the tendency not to "think out of box" appeared to be quite problematic as some requirements needed to be specified in too much detail and verified multiple times to ensure that the requirements get implemented rightly.

The cultural differences also made it difficult to build relationships between the offshore team and the internal customers of the systems being developed/maintained. These relationships were important for making the clarification process effective and efficient. The offshore team members were more inclined to have respect for authorities but their onshore counterparts believe in equality without giving extra respect to their bosses.

V. LIMITATIONS

The potential construct validity threats were minimized by having both researchers to conduct most of the interviews. They provided complementary explanations to clarify the questions for the interviewees. The semi-structured interviews enabled us to ask for elaborative answers through discussions with the interviewees. Since the findings are based on a single case study in a particular context, our findings can only be generalized to similar cases.

We tried to ensure reliability by audio recording and verbatim transcribing all interviews. However, the findings mainly result from researchers' interpretation of the data [23], [4]. All the main findings were discussed and verified by both researchers. Our findings are mainly based on the analysis of the qualitative data gathered from the interviews. However, we consider an interview as a source of rich data, specially having interviews from both perspectives of onshore and offshore centers have also helped us to see the overall picture and collect quite rich data. We did not conduct any formal observations of the work activities, we participated in several meetings and spent time at the offshore centre during which we had several short discussions with the team members. The notes and understandings from those interactions helped us to analyze the data and contextualize our findings.

VI. DISCUSSION AND IMPLICATIONS

We discuss the findings with respect to the first research question “*What are the structures (i.e., work, social, and communication) implemented for supporting a cross-organizational extended team model? And what affordances these structures provide to address GSD challenges?*” in sub-section A. We also present our reflections about the existing structures found in a cross-organizational ETM and the affordances provided by those structures to support collaboration and coordination. Then, we discuss the findings with respect to the second research question “*What are the challenges that have been introduced or not addressed by the existing structures?*”

A. Structures and Affordances

The ETM provides access and utilization of software development resources through a long-term partnership with a vendor whose staff are completely integrated with the client’s software development team [20]. This model promotes the relationship between client and vendor from outsourcing to collaborative partnerships. Such kind of arrangement is similar to inter-organizational virtual teams [8],[17], [11]. This model supports an optimal alignment between the supply of highly technical resources at the vendor side with the demands of the diverse projects on the client side for allocating individuals to multiple small/large projects. Though the dynamic interdependent work structure enables agility and quick response to the changes [10],[18], it requires high level of trust and collaborative spirit for sharing knowledge, which are being created through appropriate social and communication structures.

Our study has revealed that the social and communication structures for supporting ETM have afforded team members several mechanisms of building a high level of trust. One of these means is the equality model that reinforces the feeling of respect, dignity, and openness necessary to effectively work in an environment where uncertain requirements and task switching are a normal practice because of the nature of the work structure and certain socio-cultural differences. Hence, it is clear that this kind of work structure dynamicity needs to be supported by appropriate social and communication structures in order to achieve smooth flow of information and high level of collaboration.

Our findings demonstrate the existence of a thick flat communication pattern between distributed team members coordinated by several senior roles. This kind of communication pattern is considered a supportive strategy for a dynamic interdependent work structure [10]. Whilst the work structure implies the need of frequent interactions between distributed team members, the managerial support for social structure and the available infrastructure in terms of media (e.g., audio/ video conference, IM, desktop sharing) appear to have minimized some of the key communication challenges usually associated with GSD projects. We argue that the flat communication hierarchy and general encouragement for more communication help build the feeling of team-ness, resolve misunderstandings, improve

collaboration, and provide visibility into the status of the work in ETM. Moreover, this pattern enables agility across distributed teams by sharing knowledge through frequent conversations and emails rather than investing time and effort on preparing and reading extensive documentations.

Moreover, the policy of encouraging the team members to talk to each other, formally and informally, through available communication channels (e.g., IM over Skype, emails) has provided the team member with social affordances for building social ties that has enabled them to feel comfortable in initiating conversation for sharing technical and contextual information to keep each other aware of the context and work. These initiatives have helped team members to address the GSD challenges caused by lack of informal communication [1, 13]. While many studies enumerate reduced trust [13] lack of awareness and team spirit [13] as difficulties associated with distance factors, our study demonstrates that the mechanisms in place to improve social structure such as equality model and “no blame game”, have been successful in building the feeling of team-ness and trust among the offshore and onshore team members of the ETM.

Our study has also revealed that the unique opportunity for the senior managers to have strong social network significantly helps build and maintain ETM based on the high level of trust between two sides. The social ties between managerial staff can trickle down to support social ties between the members of the ETM. Hence, despite a work structure that introduces interdependencies, the supportive social structure and communication structures have afforded the team members several opportunities to informally interact and communicate on regular basis and it has enabled them to build the feeling of team-ness, improve collaboration and move towards a self-organizing team format in order to support a highly dynamic work structure.

B. Challenges and Recommendations

Whilst the studied work, social, and communication structures appears to have helped team members to address some of the commonly known GSD challenges (e.g., lack of trust, reduced informal communication, and lack of awareness) to an extent where their negative impact is manageable, the current structures have either introduce their own challenges or have indirectly exacerbated some of the known GSD challenges.

Communication gap is considered a common GSD challenge [6]. The participants reported this challenge despite having a communication structure that was designed to afford several mechanisms of formal and informal means of communication for supporting the work and social structures. The affordances provided by the existing communication structure and the associated technological support should have more alignment with the communication requirements of the work and the social structures based on the fact that the end-users are not able to interact with the offshore team members. One possible solution can be the use of a technology that can afford real-time translation [2] to support direct communication between the end-users and

offshore. For example, Google-Translate, which is used by some developers when they receive something in Danish.

We also recommend an adjustment in the current work structure to reduce the unnecessary interdependencies and context switching. For example, putting the staff from the onshore infrastructure support department in direct contact with the offshore team members appears to be causing difficulties due to language barrier and lack of social ties. One potential redesign option can be to make the onshore team members responsible for dealing with the deployment related issues in order to decrease the need of communication between the onshore infrastructure and offshore development staff. This change will enable the onshore team to gain a better understanding of the deployment problems and to solve them by working directly with the infrastructure staff and the end-users of a system.

Recently, there has been a change in the work structure in terms of making the UX team responsible for the requirements engineering activities. This change is expected to improve the quality of requirements elicitation and specifications. According to this change, the UX team will assume a centralized role between the development team (i.e., onshore and offshore) and customers. Whilst this change is expected to improve the quality of the process and artifacts, it will also introduce new interdependencies between the development and UX teams. For the offshore development team, this change may introduce unavoidable delays because of relatively small size of the UX team without affording new mechanism of addressing the delayed feedback issues.

Distribution of domain knowledge within several types of the customers of the systems being developed, problems with the requirements engineering processes, and inability of the offshore development team result in a huge number of clarification queries, which are unlikely to be responded quickly. This situation causes long delays and context switching problems. Though the role of communication facilitator and flat communication hierarchy appear to be helpful, there is an urgent need of adjusting the work and communication structures in order to afford the mechanisms aimed at reducing the delays and enabling the offshore team and the internal customers to communicate directly for seeking clarifications and feedback.

The challenges related to tight deadlines and context switching appear to be caused by a tendency of being optimistic on the part of the offshore project managers. Most of the decisions about the deliverable timelines are made based on the memory and experience of individual managers who may have different cultural and personal biases. One way of improving this situation is to redesign the work structure in order to introduce new mechanisms of systematically gathering and sharing the important data points about the required effort and the available resources before making decisions in terms of matching the WIs with the available resources. This arrangement can introduce realistic schedules and to reduce the context switching. The management also needs to raise awareness about the cultural

tendencies of being optimistic and not saying “No” even when it is necessary to do so in order to avoid any potential risk to a project.

The “equality model” is a good strategy for letting the offshore developers feel confident and encouraging them to “think out of the box” for proposing and implementing solutions. There is a need of an infrastructure that can afford the offshore team members the information required for seeing their role in the big picture of a system being developed and being able to think beyond what has been given to them for implementation. One such infrastructure can be an integrated environment for open and free discussions, brainstorming potential solutions, sharing views on different parts of the requirements and systems, and listening and appreciating others’ perspectives, especially from those who have easy access to the domain knowledge.

Successfully implementing ETM needs to have high level of trust across the distributed teams for smooth collaboration. The management of both organizations involved in the studied ETM has tried to build the trust by introducing equality model and flat communication structure. However, the current social and communication structures appear to have added extra burden on the development team members as they end up spending time on clarifying their views on different cultural and social issues and gaining knowledge about each other’s societal problems. However, the cultural distances and curiosities about each other’s culture and society continue to exist. There is a need of drawing a balance between work and social structures so people can gain knowledge about each other’s culture and societies that is sufficient enough to feel comfortable with each other for working in a team rather than getting to know the nitty-gritty details of each other’s religious and cultural believes.

C. Implications for Practice and Research

The research results provide empirically found information that can be useful for practitioners’ understanding about designing and implementing ETM in GSD with appropriate structures in order to afford different means of supporting collaboration and coordination.

Practitioners can take into account the formation of the studied structures and the roles introduced to support the implemented structures and the potential strengths and weaknesses of the reported strategies when introducing ETM for their GSD projects. The findings can also enable them to assess the extent to which the studied structures and the associated affordances can help address GSD challenges. They can also collaborate with researchers, including us, to try the reported model and strategies and provide feedback in order to contribute to the body of knowledge on this topic.

The findings are expected to make important contribution to the literature on the role of appropriate structures in software development [3, 15, 24]. The researchers can use the results in several ways. For example, the results can provide a reference framework for further research on different aspects of ETM in GSD, especially the influence of the interplay among different structures (i.e., work, communication, and social) on enabling or hindering

coordination and collaboration in ETM. Studies should also be conducted to determine if the social structure incorporating social networking technologies (e.g., Twitter, Facebook, and Linked In) can have a positive or negative impact on work structures and productivity. It is also hoped that the results of this study will stimulate researchers to discover the underlying factors that lead to and/or influence the use of different structures for implementing ETM. Moreover, research is also needed to provide a framework for selecting appropriate GSD technologies for different types of structures for an ETM.

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