Using the PMBOK® Guide to frame GSD Coordination Strategies

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Abstract: Global software development (GSD) carried out at various locations is impeded by global distance categorized as exterior and interior. To overcome this, specific communication strategies are required to coordinate a range of activities between client and vendor teams working on GSD projects. The literature on GSD recommends many coordination strategies, but tends to take the client viewpoint as vendor companies have been underrepresented in publications. In this paper, we compare coordination strategies identified in both the literature and in primary research which we conducted in Indian vendor companies with the Project Communication Management section of the PMBOK® Guide. This comparison helped us to define a set of expert-validated coordination strategies for use by GSD practitioners. While developed from the vendor rather than the client perspective, indications are that project managers from both client and vendor organisations can implement these strategies to overcome GSD coordination issues.

Keywords: Global Software Development, Coordination, Communication, Project Management, Vendor

I. INTRODUCTION

Over the last two decades, Global Software Development (GSD) has become the norm for large sections of the software industry [1]. In the highly competitive software development environment, international companies have to enable themselves to operate GSD successfully. However, GSD is impeded by global distance [2], which can be grouped into two categories - exterior and interior. Exterior distance is due to geographical, cultural and temporal differences [2] [3]. Interior distance is created when there are organisational, technological or knowledge differences [4] [5]. The outcome of these global distances is that they raise communication, control, culture and coordination issues in GSD [6]. While each of these is of interest to GSD researchers, the research presented in this paper focuses on coordination specifically from the perspective of guidelines for project communication management as defined by the PMBOK® Guide, 2008 [10]. Communication is a process by which information is exchanged between individuals through a common system of symbols, signs or tools. Communication is the key to team-based success [19] and is a mediating factor affecting both coordination and control [2]. Communication between collocated and distributed teams can be synchronous and asynchronous. Various tools and techniques are used to support communication in GSD and the management of communication is an essential activity for supporting the coordination of GSD projects across sites.

Coordination between distributed teams is one of the most difficult-to-improve aspects of GSD [8] [14] [15] [16]. There is no single reason why software projects fail, but one of the main problems is coordinating activities within software systems [9] [16] [17]. Malone and Crowston (1990) have defined coordination as ‘the act of working together harmoniously and managing interdependencies between activities to achieve project goals in which several actors are involved and multiple activities are performed’ [7] [18]. A variety of innovative research and development activities are necessary to sustain complex coordination needs in GSD [2].

With outsourcing and offshoring becoming a norm for GSD [1], from the available literature it is evident that several effective strategies are implemented to overcome GSD coordination issues. Many of these strategies followed are original and innovative but are not prevalent. Their occurrences are random and vary according to the circumstances as and when they are essential. There is a need for appropriate techniques to ensure a compatible process across sites.

Despite the availability of sophisticated collaborative and communication tools, GSD coordination continues to be challenging [20]. As communication is considered as a mediating factor affecting both coordination and control [21], putting emphasis on communication can resolve the coordination issues that adversely affect GSD projects.

The research presented in this paper is part of a larger study carried out to develop GSD-COORD - a coordination model
for GSD teams. The preliminary findings of this research work are available in [6] [11] [12] [13].

The paper is structured as follows; Section 2 discusses the Research Motivation. Section 3 explains the Research Methods, while Section 4 gives an overview of the PMBOK® Guide. Section 5 discusses the comparison between coordination strategies we found during our research with the techniques in Project Communication Management section of the PMBOK® Guide. Section 6 provides Discussion, Section 7 presents Further Work and Section 8 concludes the paper.

II. RESEARCH MOTIVATION

An appraisal of the literature indicates that the published studies mainly focus on the perspective of the clients who are outsourcing software development. This finding is supported by the findings of [22][23]. This implies that vendors, who perform an important role in GSD, are underrepresented in the literature. Furthermore, there is limited documented information of the actual issues that exist between clients and vendors. There is a wide gap in the understanding of the benefits and issues of GSD particularly from the vendor perspective. There is also a lack of understanding about the triggers that cause issues between the client and vendor sites. Hence, this research study is conducted from the vendor perspective.

Additionally, research carried out by Richardson et al [24] asserts that published software process models do not cater explicitly for GSD, and our literature review and focus group supports this assertion. We emphasize that, in order to alleviate global distance problems for the effective management of GSD projects, it is necessary to collate a set of proven project management techniques that relate specifically to coordination strategies. We have confirmed that while there are techniques available for project management in software engineering standards, there is no particular focus on GSD. Vendor companies use standards such as the CMMI, ISO9000 and PMBOK® Guide although these do not focus specifically on GSD.

Consequently, the motivation for the research presented in this paper is to reveal specific communication strategies that are useful in the coordination of tasks between GSD teams and are supported by the PMBOK® Guide, 2008.

We have identified our key research question as:

RQ: Can we provide a strategy for overcoming various communication challenges encountered while coordinating tasks between distributed teams working on GSD projects?

In this paper we specifically focus on the following related sub-question:

SRQ: Taking a project communication management perspective; how is the scope of the PMBOK® Guide relevant for GSD Project Management?

III. RESEARCH DESIGN

Initially, we carried out a Literature Review to map and categorize studies [25] that reported the research on coordination strategies. These were clustered to form a set of analogous practices. Our next step was to investigate Multiple Case Studies in which we carried out empirical research with an explicit focus on the vendor perspective. Five multinational companies and one national company participated in this study. All of these companies are based in India, a major outsourcing destination country [26]. We used small but opportunistic and focused samples [27] with a stratified purposeful sampling strategy to include information-rich cases. We interviewed people in different roles - mainly Project Managers and Senior Staff. The participants managed teams with 25-500 team members working on outsourced GSD projects. Data was gathered using multiple-case sampling [28]. Participants answered online-questionnaires and we followed these with telephone and face-to-face interviews that were transcribed. Content analysis [29] was performed on the transcribed data where we incorporated conceptual content analysis including cognitive mapping from relational analysis [30]. The data was coded mainly into pattern codes with limited interpretative and descriptive codes [31].

The third stage of research design involved Model Mapping, where a focus group [32], facilitated by one of the authors, discussed the identification of a standard that can be used as a basis for the provision of a strategy for overcoming GSD communication challenges encountered while coordinating tasks between distributed teams working on GSD projects. Following this, a gap analysis was performed to compare GSD practices with the recognised software development processes and project management standards. This resulted in us identifying that the PMBOK® Guide [10] could be used to map coordination strategies. Through mapping the GSD practices with the PMBOK® Guide, we developed the GSD-COORD, a coordination model for global software development teams.

We validated the model in the final stage of the research. An expert panel [33] approach was followed. Our panel included GSD researchers and GSD practitioners who worked on and/or managed GSD projects. The experts in the validation process helped to refine the GSD-COORD Model to make it applicable to the software industry.

IV. PROJECT MANAGEMENT BODY OF KNOWLEDGE (PMBOK® GUIDE, 2008)

The PMBOK® Guide is a recognised standard that describes established project management norms, methods, processes, and practices for a range of industries including the software industry. ‘Good practices’ in the PMBOK® Guide are generally applicable to projects and there is consensus about their value and usefulness [10]. These ‘good practices’ have been contributed by project management practitioners.

We initially carried out an in-depth review of the PMBOK® Guide to identify the specific sections that correlate to our research work. The PMBOK® Guide has five
sections - project human resource management, project communications management, project scope management, project cost management and project quality management. We established that the Project Communication Management chapter of the PMBOK® Guide [10] includes the techniques and good practices that are relevant to our research work and are essential for communicating while coordinating GSD projects.

The PMBOK® Guide states that project communication management is a process in which information is exchanged amongst stakeholders through a common set of symbols, signs, behavior or tools. Effective communication is essential to create a bridge between diverse individuals who are involved in a project [10]. An appropriate communication plan helps to manage and connect various levels of expertise, different cultural and organisational backgrounds and interests of team members necessary for the execution of the projects [10]. Creating an appropriate project communication management plan helps in coordinating the activities of team members [10]. Communication has been recognised as an important factor for GSD [21][34] and the project communication management process includes communication techniques that can be used as a basis to help overcome the communication issues and challenges that arise while coordinating GSD projects.

V. MAPPING GSD AND THE PMBOK® GUIDE

We mapped coordination strategies of GSD with the project human resource management section and project communication management of the PMBOK® Guide. The mapping of the Project Human Resource Management section is presented in [13]. In this paper we present the mapping with the Project Communication Management. Our previous research [40] has shown that without effective communication processes, GSD projects are more likely to fail. Consequently, while PMBOK Guide communication strategies are well known to project management, it is of particular benefit to GSD projects to spend time and effort setting up good communication processes. Following the mapping, we were able to categorise the recommended techniques and strategies into three distinct groups from a GSD perspective:

A. Techniques in the PMBOK® Guide performed within GSD projects in practice.

B. Techniques in the PMBOK® Guide not performed within GSD projects in practice.

C. Techniques not in the PMBOK® Guide but are performed within GSD projects in practice.

These potentially could support the GSD communication management plan to keep track of activities occurring at various geographical locations.

A. Techniques in the PMBOK® Guide implemented within GSD projects in practice

We established that four techniques are common to both GSD and the PMBOK® Guide. They are: Identify stakeholders; Plan communication; Communication models; Communication outputs.

i. Identify Stakeholders

The practice suggested in the PMBOK® Guide is to identify all key stakeholders within the project who need to communicate. The key stakeholders are the members who have active involvement and whose role can have an impact on the execution, deliverables or completion of the project. Early identification of stakeholders is critical as it helps to analyse their level of interest while communicating within the project [10]. It is necessary to document relevant information vis-à-vis their communication requirements, contribution and impact on the project success [10].

The PMBOK® Guide states that an appropriate plan is required to determine stakeholders’ involvement to maximize positive influences and mitigate potential negative impacts on various communication channels [10]. It is also necessary to classify all the stakeholders according to their role, interest and involvement in the project. This enables the project managers to focus on the relationships necessary to ensure the success of the project. These relationships can be leveraged to build coalitions and potential partnerships that enhance the chance of project success. It is essential to identify and classify the potential impact or support each stakeholder could generate within the project to define an appropriate communication strategy. The communication plan must be periodically reviewed in order to include potential changes.

In GSD outsourcing projects, there is a need for constant communication between client and vendor team members. In our study, we have identified comparable communication strategies in the literature and in the software companies that we researched. The literature states that important stakeholders within distributed projects should be identified. Team members within various teams, also called ‘panel points’ [35], should take the responsibility of communicating project information with the stakeholders of the project. Their role must be to identify the information needs of stakeholders and to connect various teams to ease coordination [35]. Our case study research supports these findings in the literature. We have seen the necessity and significance to prioritize the information that is to be communicated to each team and team members. This information should be systematically assessed for access and impact. A senior executive in our study stated:

...We also analyse when and how the information will flow within the project and its impact on each team and team member within the project.

Following this process can result in effective communication and information flow within the project.

ii. Plan Communications

The PMBOK® Guide states that it is essential to analyse communication requirements within the project to plan the communication requirements of stakeholder. This should specify who needs what information, when they will need it, how it will be given to them and by whom. It is important to

1 Quotes taken directly from our primary study are given in italics.
identify the information needs of the stakeholders and to
determine a suitable plan to meet those needs for the project
success [10].

An effective communication plan allows project managers
to document the approach to communicate efficiently with
stakeholders. This can ensure that the required information is
provided in the right format, at the right time and with the right
impact. The PMBOK® Guide states that the communication
requirements analysis helps to determine the information needs
of the project stakeholders.

The project manager must consider the number of potential
communication channels essential for the project. A key
component of planning the project’s actual communications is
to determine and limit who will communicate with whom and
will receive what information. The PMBOK® Guide states that
while doing this the project manager must consider organisation charts, role and responsibility and their
relationships along with the internal and external
communication plan [10].

In addition, the PMBOK® Guide states that various factors
must be taken into consideration while planning for the project
communication such as urgency of the need for information,
availability of technology, experience and expertise of the
stakeholders to use the technology and the need of training and
learning by team members. Also, while planning for
communication, the project managers must bear in mind changes in the technology used and in the project environment.

This technique of creating a communication plan is very
helpful from the GSD project management perspective, as this
will facilitate smooth and effective information flow within
distributed software development projects. In the software
companies we studied, some project managers stated that they
craft a comprehensive communication plan for the entire project
in order to have an uninterrupted flow of information within the
distributed project sites. This plan normally mentions the frequency of how, when and who will generate and
communicate the information within the project. When interviewed, one project manager stated:

The plan mentions the transfer of documents through
mails and other channels...verbal communication using
various tools...it is quite a comprehensive document
prepared with the consent of client site team members.

Separate communication plans are formulated to ensure efficient communication between client and distributed vendor
site team members. While planning for communication, the
information generated is flagged on the basis of its significance
and a complete record of communication across sites is
maintained and analysed to enhance the quality of
communication and information flow.

The GSD literature also states that there are various tools
and techniques used for effective communication between
geographically dispersed team members. The framework
mentioned by [36] states that information analysis must lay out
aspects such as information representations, communication
strategies, knowledge repositories and sharing modes. The
understanding is that this technique is not a regular strategy
that is followed within all software companies. If this technique
is regular and employed as a part of the project, it can help both
the client and vendor teams communicate easily throughout the
project life cycle. For GSD to be successful, it is essential that
a methodical communication plan is implemented and followed
stringently to stabilize the communication and information
flow within the GSD projects. Additionally, this can help both
the client and vendor team members to communicate easily to
overcome various issues throughout the project life cycle.

iii. Communication Models

The PMBOK® Guide states that a basic communication
model is necessary to demonstrate how information is sent and
received between stakeholders. Various components in the
communication models such as sender, receiver, medium,
interferences, input and output need to be taken into account
when planning project communication. There are various
challenges that need to be overcome to effectively
communicate within software projects. The PMBOK® Guide
indicates that, in a distributed and multinational project, for a
team member to successfully communicate a technical concept
to another team member in a different country can involve
encoding the message in the appropriate language, sending the
message using a variety of technologies, and having the
receiver decode the message and reply and provide feedback.
Any interruption introduced along the way can compromise the
original meaning of the message. Interactive communication
can be the most efficient way to ensure a common understanding by all participants on specified topics and
includes meetings, phone calls and video conferencing. Based
on communication requirements, the project managers have to
decide what, how and when communication methods are to be
used in the project.

Within our case study research, the software companies
demonstrated various communication models that are planned
and established within the client time zone and that are kept
open full-time (24/7) for constant and effective
communication. Such communication models are called
‘communication protocols’. These are followed by all
distributed teams and team members within the project for
simple, appropriate and non-overlapping communication.
Project managers monitor whether team members are able to
communicate productively and whether proper information is
exchanged within the available timeframe. This can ensure that
all team members have continuous formal as well as informal
communication with the client-side team members. In addition,
language and accent issues in oral communication can be taken
care of by giving appropriate training to team members. The
senior executive of a large multinational company explained
the process within their organization:

We establish communication protocols which clearly
mentions the role of each team member while
communicating and a clear idea of who is going to
communicate with whom... using which tools and the
frequency for communication... complete analysis of all
the aspects of the project is done while creating such
models.

Project managers also use these communication models to
monitor if team members are able to communicate
productively, exchanging appropriate information within the available time.

iv. Communication Outputs

The PMBOK® Guide states that the project communication management plan must include details of communication production and output, providing details on:

- Stakeholders communication requirements;
- Information that is communicated. (language, format, content, level of detail);
- Reason for the distribution of that information;
- Person responsible for communicating the information;
- Person or groups who will receive the information;
- Tools or technologies used to convey the information.

Our case study project managers have stated that in the communication protocol it is normal for them to devise a well-planned communication output scheme. This gives details of how to keep a record of the communication output. One interviewee stated that:

...record of communication output is useful to us while conducting internal audits...the information generated mentions in detail the sender, receiver, tools used, etc. while communicating.

The techniques mentioned in the PMBOK® Guide reflect the regular practice that we observed in the vendor companies. However, we have not seen these practices identified previously within the GSD literature, and therefore, we believe that it is important for these techniques to be highlighted for GSD software companies.

B. Techniques in the PMBOK® Guide not implemented by GSD teams in practice

i. Information Distribution

During our research in the Indian vendor companies and in our systematic literature review, we have seen no evidence of the Information Distribution activity being undertaken in the GSD environment, although it is presented in the PMBOK® Guide. Information distribution is the process of making relevant and planned information available to all the stakeholders within the project. The PMBOK® Guide states that effective information distribution must include techniques such as:

Sender-Receiver Models – An appropriate outline of the chain of all senders and receivers within the model must be maintained. The model must also keep a feedback loop to record the response received on the information that is distributed and to understand the barriers to communication. The model can also include details of whether the information is distributed to individuals or in group meetings, video and audio conference, chats or if any other communication method will be applied. While the software companies that we researched for this study establish communication protocols for appropriate and non-overlapping communication, we note that the sender-receiver models technique from the PMBOK® Guide gives further guidance on how to improve information distribution through these communication protocols.

Choice of Media – The PMBOK® Guide suggests that information senders must be given a choice to use the medium to communicate information based on specific situations. Various communication tools, for instance, telephone calls and email, can be used to distribute information. Details about when to communicate in writing versus orally, when to write an informal memo versus a formal report, or when to communicate by face-to-face or via email must be familiar to the senders. The PMBOK® Guide also states that certain writing styles, for example, the use of active or passive voice; sentence structure and word choice can also be applied while distributing the information to stakeholders within the project.

Information Distribution Policy – The PMBOK® guide states that certain rules must be followed while distributing information amongst the stakeholders within the project. This helps to ease communication difficulties and create a better understanding about the scheduled meeting and discussions. This technique of systematically distributing information can be very helpful in GSD projects as most of the issues that occur in GSD projects are because of improper communication and the lack of a precise process. Various research studies have proposed communication patterns and models for distribution of information that can be applied to both distributed and collocated teams [21][37].

This technique and these models can help to set a standard process of communication within distributed teams across various sites in GSD project.

Following our study, we believe that the guidelines presented in the PMBOK® Guide can help to implement information distribution in a more successful way in GSD projects. Many issues that occur in GSD projects are due to improper information distribution and lack of a detailed and precise communication process. There have been calls by GSD researchers to define such information distribution techniques when setting up GSD teams [6][11][34]. Despite this, however, there is no evidence of any systematic techniques for distribution of information within the GSD literature, nor have we observed this in our primary research. The activity, as presented in PMBOK® Guide, can help to set a standard process of communication and distribution of information within distributed teams across various sites in GSD project.

C. Activities not in the PMBOK® Guide performed by GSD teams in practice

We have identified two GSD project communication techniques not included in the PMBOK® Guide, which can be used to support good communication while coordinating activities in GSD: Appoint communication agents and Implement communication training.
i. Appoint Communication Agents

A specific role that we have identified in our primary study of GSD projects and in the GSD literature is that of communications agent. The role of the communication agent is to manage the information flow within the GSD project. They are basically the team members within various teams also identified as ‘panel points’ [35]. Their role is to identify stakeholders’ information needs within the distributed project, to connect various teams in order to ease coordination and to be the main communication conduit to the non-collocated teams [35]. Once key stakeholders within the GSD project are identified, the communication agents can act as a communication short-cut between teams, thus allowing for complex and subtle communication to flow in both directions [38].

Additionally, our case studies suggest that the vendor site team members can be assigned this explicit role. Their responsibility is to communicate the exact information to the stakeholder within the project and monitor information flow within various geographical locations. A project manager that we interviewed in a vendor company stated that:

*We have special roles defined to manage communication and information flow with the clients and distributed team members...the role of communicator is to track all the communication channels, manage the information requirements of various distributed teams and team members and overcome all the issues that occur during communication.*

Appointing communication agents is not mentioned in the PMBOK® Guide although it is a significant activity within GSD projects. Our research has demonstrated that GSD projects can benefit from having communication agents in place.

ii. Implement Communication Training

Our primary study has revealed that various training sessions are often carried out for the team members in vendor sites to help them to overcome communication issues within GSD projects. This training focuses on the enhancement of communication skills of GSD team members and they assist project managers in overcoming any inadequacy of communication skills among the project team members.

The emphasis during communication training sessions is usually on the language, accent, dialect and style of communication. Project managers have to confirm that team members have a good proficiency of the working language, which in India is English, and they understand the clients’ accents. A difficulty they face is that, at times, team members can find it difficult to understand the accent of the clients or team members from international geographical locations and often, the dialect of English spoken may differ from that of native English speakers. Therefore, team members can be reluctant to communicate internationally, and this can result in communication issues overriding technical knowledge.

However, it is important for project managers to ensure that team members understand these issues while operating within a multi-national environment. A basic aptitude level of English proficiency is important while communicating with clients...having good communication skills

| Table: 1 Mapping GSD Coordination Model and Project Communication Management |
|---------------------------------|---------------------------------|---------------------------------|
| Technique                       | Documented From                 | Significance in the GSD Projects |
| Identify Stakeholders           | GSD Literature, Researched Case Studies & PMBOK® Guide | Helps to determine whose interests need to be taken into account while communicating within the project |
| Plan Communications             | GSD Literature, Researched Case Studies & PMBOK® Guide | Allows to document the approach to communicate efficiently with stakeholders |
| Communication Models            | Researched Case Studies & PMBOK® Guide | Necessary to demonstrate how information is sent and received between stakeholders |
| Communication Outputs           | Researched Case Studies & PMBOK® Guide | Well planned communication output scheme that gives details of how to keep a record of the communication output |
| Information Distribution        | PMBOK® Guide only | The process of making relevant and planned information available to all the stakeholders within the project. |
| Appoint Communication Agents    | Researched Case Studies only | Facilitates smooth and effective information flow within the distributed software development projects. |
| Implement Communication Training| Researched Case Studies only | Helps to overcome various issues related to language and cultural differences that crop up during team communication. |
irrespective of the technical skills and domain knowledge is important because it helps members to communicate effectively with the clients...when selecting team members...we look for people with good communication skills...trainings sessions are held to enhance communication skills.

This strategy is not stated in the PMBOK® Guide. We suggest that this is an important strategy which should be implemented by vendors operating in GSD environment, as its implementation can help to overcome various issues related to language and cultural differences that crop up during team communication.

VI. DISCUSSION

Through our research work we have collated significant coordination strategies from various sources to develop the GSD-COORD Model that includes key processes and strategies for coordination of tasks between distributed teams working on outsourced GSD projects. In this paper we have presented the mapping study with the project communication management section of the PMBOK® Guide with a focus to answer our sub-research question that asks whether the scope of the PMBOK® Guide is relevant for GSD Project Management.

The literature review we undertook indicated that most of the research on GSD is carried out from the client perspective. This suggests the need to conduct more studies from the vendor point of view to overcome the tangible issues of GSD. However, it has highlighted various strategies for effective coordination between client-vendor teams. These strategies are implemented and successfully followed by software companies that manage GSD projects. Many of these strategies are original and innovative but not prevalent and their occurrences vary according to the situation in the project.

The primary research presented in this paper was conducted from the vendor perspective. This has allowed us to understand various issues that exist between client-vendor teams working on GSD projects. There are several key issues that vendor side teams confront while coordinating tasks with the client team. These need to be addressed for effective coordination. Further, we have revealed various innovative strategies implemented by vendor companies to resolve coordination issues and successfully manage GSD projects.

In the course of this research study, we identified that the prevailing body of knowledge in software engineering for project management does not focus on the management of globally distributed software development projects. It implies that there is a requirement to develop a structured standard that can focus specifically on Global Software Engineering.

The PMBOK® Guide is a recognised standard for project management which describes the established norms, methods and processes for project management. In this research paper to answer our sub-research question we have examined how project communication management techniques mentioned in the PMBOK® Guide are useful for comparing GSD communication strategies that we identified through the literature and primary research conducted within Indian vendor software companies. This comparison allowed us to classify and propose specific communication strategies to coordinate GSD projects.

Techniques such as appointing communication agents and communication training are not mentioned in the PMBOK® Guide. However, communication agents are essential to support coordination as they are often the main communication conduit. Communication training helps to enhance the communication skills of team members for working on GSD projects. These strategies are well established within vendor companies and are endorsed by client companies in GSD. Therefore these strategies need to be acknowledged and included as part of regular practice to ensure the success of the GSD project.

Working in a distributed environment means that organisations need to carry out more robust processes than working in a collocated environment for which the PMBOK® Guide was designed. It is therefore not surprising that, through investigating our research sub-question with multiple case studies and literature review, we have successfully uncovered strategies in use which are not present in the PMBOK® Guide. These can help to address GSD coordination issues. Additionally, we have also documented and proposed a new communication technique, namely information distribution mentioned in the project communication management section of the PMBOK® Guide. This technique includes sub-techniques such as Sender-Receiver Models, Choice of Media and Information Distribution Policy helpful for GSD project coordination. This technique in particular emphasises the need to make relevant and planned information available to all the stakeholders within the project. We have not seen this technique previously recognized by GSD practitioners nor researchers in GSD projects. Our subsequent stage was to develop the GSD-COORD Model [39]. We can therefore now address our sub-research question and confirm that the PMBOK® Guide, even though it doesn’t take a global view of software development, has the scope to add new practices to the field of coordination in GSD. This is an important contribution to the GSD field, as it has commenced the development of a model integrating GSD with established project management practices. We believe this study is a significant contribution to this vast and complex field of research.

Our explicit aim through this research was to develop a GSD Coordination Model (GSD-COORD). This model consists of 10 processes and 53 strategies. Each strategy in the GSD-COORD Model includes its significance and practices that can be followed while managing outsourced GSD projects. The significance of each strategy implies the importance for coordination of tasks within that process. The practices presented under each strategy are based on the combination of findings from the literature, case studies, the PMBOK® Guide and expert validation.
The Communication and Coordination processes presented in GSD-COORD are crucial for the coordination of tasks between distributed teams. It includes strategies and practices revealed from various sources. These will be helpful in the distribution of clear and contextual information amongst all distributed sites. In our validation of the GSD-COORD Model experts, endorsed the role that communication plays in team coordination, stating that it is essential that communication is clear, unambiguous and accurate at certain levels and stages of the project.

The processes and strategies in the GSD-COORD Model are adequate, inclusive and adaptable. These can be followed by project managers when managing GSD projects. The GSD-COORD Model is an adaptable approach to project management where the processes and strategies can be tailored to suit different global and organizational settings.

For academia, the research results provide understanding of GSD project coordination. This research can act as a roadmap to identify additional challenges that impede GSD projects. It is not claimed that the results presented are complete but the steps taken to conduct this study offer a starting point for other researchers to conduct further research.

VII. FURTHER WORK

The current GSD-COORD Model is validated following an expert panel approach. As part of the future work, we aim to evaluate the GSD-COORD Model in various software companies that manage outsourced GSD projects to make it more adaptable. An interactive tool will be developed to present the model which will propose practices that need to be followed while implementing specific strategies suggested in the GSD-COORD Model. Analysis of this evaluation process can help to refine and update the existing GSD-COORD Model. Further, we also have planned to integrate various tools that are available for communication and coordination between distributed teams with the GSD-COORD model.

VIII. CONCLUSION

The research presented in this paper is part of a larger study. In this paper, we have established that the scope of the PMBOK® Guide is relevant for GSD Project Management, from a project communication management perspective. In answer to our research sub-question, we found that a sub-set of techniques from the project communication management section relate to communication strategies that are followed in practice in vendor companies to coordinate activities in GSD projects. This has ultimately supported the development of the GSD-COORD model that we have developed for GSD teams. Thus, the PMBOK® Guide does indeed help us to address communication issues that arise while coordinating activities in GSD projects. Though, this model has now been validated by experts, the next stage of the research plan is to implement and evaluate the model in software companies that manage GSD projects.

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