Research Framework of Evaluation Model to Assess the Effectiveness of Coordination Processes in Global Software Development Projects

A Subbarao[1] and M N Mahrin[2]
[1]Information Technology Unit, Faculty of Management, Multimedia University, Persiaran Multimedia, 63100 Cyberjaya, Malaysia
[2]Department of Informatics, Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia, 54100 Jalan Sultan Yahya Petra, Kuala Lumpur, Malaysia

anusuyah.subbarao@mmu.edu.my,

Abstract. Effective coordination is a vital aspect of successful Global Software Development (GSD) projects. Limited studies have examined coordination strategies and their related indicators. Therefore, this study focuses on assessing the coordination processes that require specific strategies and related indicators that can contribute to effective coordination. Thus, the main aim of this study is to present the entire research framework that will be used to formulate the Evaluation Model which consist of coordination strategies and related indicators. Research framework consists of three parts namely research philosophy, research design and research methods. Thus, this study elaborates each of this parts accordingly. The results of this study is the formulation of Evaluation Model to assess the effectiveness of the coordination processes in GSD projects.

1. Introduction

According to Creswell (2013), there are four research philosophies [1-2], namely postpositivism, interpretivism, transformative and pragmatic. In this study, the researcher selects interpretivism and characteristically, it is recognized as a method that best suits qualitative research in software engineering [3]. The reasons why the researcher is planning to adapt this paradigm is because in interpretivism, researchers could designate, interpret, analyze and recognize the social world through definition. The task of interpretivist research is to know and interpret human actions rather than to simplify and assume the causes and effects. In addition to that, this research involves Global Software Development (GSD) and every GSD project is unique in its own way. Therefore, interpretive approach is suitable for this study.

Research design is categorized into three types, namely, quantitative, qualitative, and mixed techniques. Qualitative studies exemplify the interpretive approach. Qualitative studies do not include numbers or numerical data. It frequently includes words or language, however may additionally use pictures, photographs or observations. For software engineering, qualitative study is generally used to examine people, situations, behaviors, events, relationships, and a few different attributes that cannot be simply quantified using technology. Usually what occurs is these attributes go across the disciplines, fields and subject matters. Qualitative studies absorb an interpretive approach to the settings with an endeavor to interpret the phenomenon to bring significance to them [4]. Qualitative research does not fit into one specific discipline; also it does not fix one set of methods on its own [4].

For this study, the researcher has adapted the interpretive approach with qualitative design to perform the research. The uniqueness within the GSD surroundings makes it challenging to describe a particular set of variables, and the data to be researched in the original framework. Activities carried out by software companies' change very unexpectedly from day to day, and it is difficult to predict their activities. Hence, the researcher believes that this research cannot be performed in a controlled and managed surrounding. Furthermore, the researcher also believes that there will not be any scientific measure, numerical data or technical piece involved in the research. Therefore, this study has adapted a qualitative design to formulate the Evaluation Model for assessing the effectiveness of Coordination Processes in GSD projects [5].

The purpose of this study is to acquire an in-depth understanding of the coordination strategies and related indicators within the GSD projects, which will be used to assess the effectiveness of coordination processes in GSD projects.

This paper is organized as the following. Section 2 discusses the activities involved in the methodology of this study. Section 3 presents the result and the discussion of this study. Finally, the researcher concluded the work in Section 4.

2. Methodology

This section discusses research methods that researcher plans to select. Research methods are selected by the researcher which involves data collection, data analysis and interpretation, and clarification that researcher recommends for the studies. The method selection depends on the types of information the researcher requires from the participants of the project [6].

To answer each research objectives, the researcher has segregated the study into four different phases. Figure 1 shows the research framework, in which the phases, activities involved, and outcomes for each phase are outlined (Figure 1).

Phase 1 is a phase where coordination strategies and related indicators are identified based on the existing coordination processes in GSD projects from the literature perspective using the SR method (Figure 1, a), [7].

Phase 2 is where the coordination strategies and related indicators are being identified based on the existing coordination processes in GSD projects from the GSD practitioners' perspectives using semi-structured interview (Figure 1, b), [8].

Phase 3 is the formulation phase where Evaluation Model to assess the effectiveness of coordination processes in GSD projects is formulated using Grounded Theory [9] and Delphi technique (Figure 1, c).

Phase 4 is the evaluation phase where the Evaluation Model is evaluated by conducting a case study method (Figure 1, d).

2.1. Phase 1

To achieve research objective one, researcher has used SR

Research Objective 1: To identify the coordination strategies and related indicators for assessing the coordination processes in GSD projects based on literature.

SR is one of the most broadly practiced approaches for analyzing the current study in the ground of software engineering. Kitchenham (2016) has stated that SR is an action of evaluation and interpretation of all accessible causes that is related to the specific study request [10]. The primary goal of SR is to distribute an assessment of study extent by consuming consistent, demanding, and auditable

procedure. This section will explain the processes of SR. To conduct this SR, Systematic Literature Review (SLR) guidelines for software engineering by Keele (2007) was used [11]. Researcher has selected SR method because this method is very systematic, and it is conducted by following a set of well-defined procedures.

There are three main phases of SR, namely planning review phase, conducting review phase, and documenting review phase. Each phase consists of numerous activities. The output from this SR is a list of coordination strategies and related indicators according to the coordination processes in GSD projects.

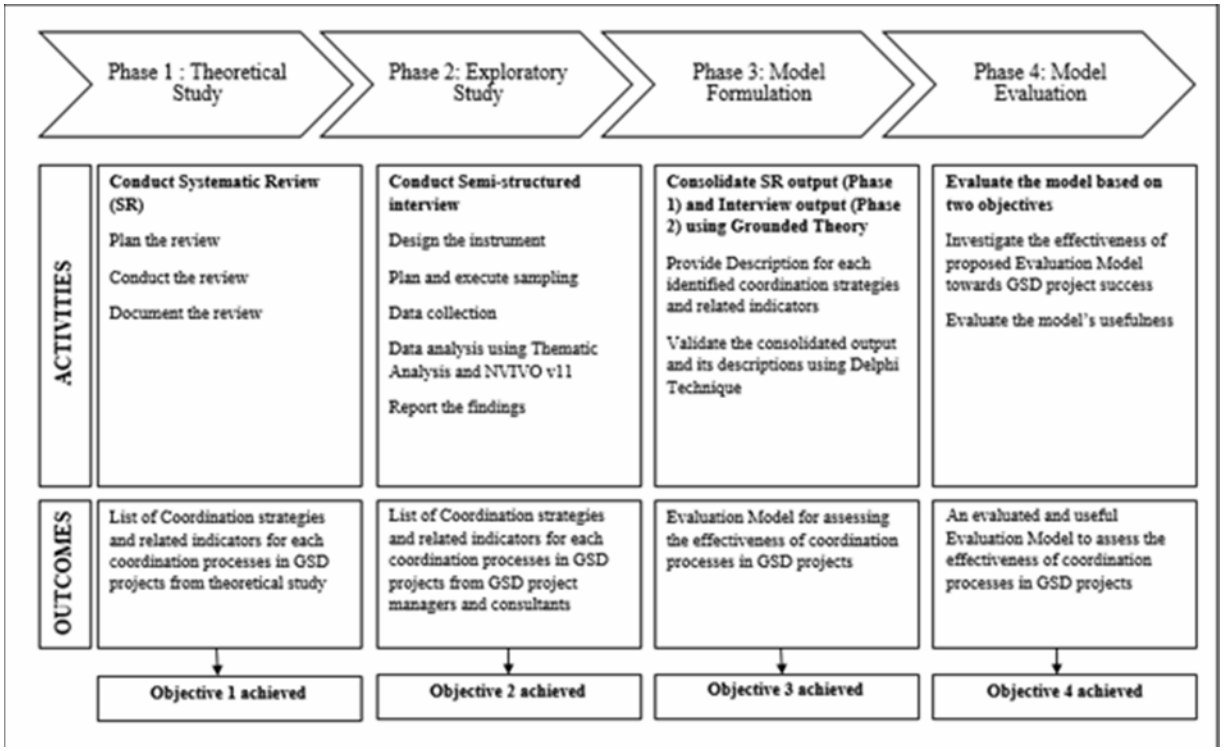

Figure 1. Research Framework consists of Phase 1 (a), Phase 2 (b), Phase 3 (c), Phase 4 (d).

2.2. Phase 2

To achieve research objective two, the researcher chose semi-structured interview.

Research Question 2: To identify the coordination strategies and related indicators for assessing the coordination processes in GSD projects based on GSD practitioners.

A semi-structured interview was conducted with respondents from different countries namely Norway, United States of America (USA), Singapore, Finland, India, Germany, Pakistan, France and Malaysia. The interview took into consideration Hesse-Biber and Leavy (2006) suggestions as given below [12]:

a) Based on the literature review findings, interview instrument was developed.
b) Potential respondents were selected with the criteria of minimum five years working in GSD industry, their position as a consultant, project manager or team leader in software development and most important they should be well experienced in handling software projects over the offshore locations at least for five years.
c) The selected respondents were contacted by the researcher through e-mail and telephone calls. Upon agreement to participate in the study, an interview appointment was set based on their

preferences.

d) Once agreed, Semi-structured interviews were conducted with the respondents.

For data collection, purposive sampling was used. The researcher used purposive sampling for this study because they knew the characteristics of the target population and then sought out specific individuals who have these characteristics to be included in the sample [13]. This type of sampling could be beneficial when you need to reach a targeted sample quickly and where sampling for proportionality is not the primary concern. Opinions of the targeted population could undeniably be retrieved using purposive sampling. Hence, for this study, the researcher identified experienced project managers who are currently dealing with GSD projects across countries at least for five years as the samples.

A semi-structured interview guide was designed to manage the discussion with the GSD project managers. The interview guide is vital to ensure similarity of interviewing method and flow of discussion. The questions in the interview guide were developed based on the literature. Some interviews took place face-to-face as they were available in Malaysia while some took place via telephone calls, and others took place via video conference. Date, time, and location were set according to the respondent's preference. All the interviews took place with the guidance of the semi-structured interview guide. Due to privacy and confidentiality issues, the respondents have the right to refuse to be recorded. Accordingly, the interviews were written. On the other hand, the interviews were tape-recorded with the respondents who gave their permissions. Each of the interviews lasted between 45 to 60 minutes.

Objective 2 was achieved using the interview report which consist of coordination processes, coordination strategies and related indicators in GSD projects.

2.3. Phase 3

To achieve research objective three, Grounded Theory method and Delphi technique was chosen.

Research Objective 3: To formulate Evaluation Model for assessing the effectiveness of coordination processes in GSD projects based on the identified coordination strategies and related indicators.

The researcher selected Grounded Theory as it delivers a meaningful means of analyzing the data and data are gathered from various sources [14]. In the software engineering field, Grounded Theory is one of the well-established methods to analyze qualitative data. The researcher use sources of data from enhanced analysis of research literature, which is SR and semi-structured interview. This was part of the data collected. Data analysis was carried out according to the theories identified by grounded theory through practicing open, axial, and selective coding techniques [14-16]. Researcher used this coding phases because it has become the most commonly practiced phases in Grounded Theory, and it is utmost prolific when all three stages of coding are practiced [17].

These consolidated strategies with the indicators as well as the description were reviewed to confirm their accuracy and to discuss their usefulness for coordination process assessment. Thus, these consolidated strategies and indicators were validated using the Delphi technique.

The Delphi technique, primarily established by Dalkey and Helmer (1963) at the Rand Corporation in the 1950s, is a commonly practiced and accepted method for accomplishing convergence of estimation regarding actual information implored from professionals within certain subject extents [18]. The Delphi technique has been established widespread as an instrument in conducting studies related to IT research especially for recognizing and ranking matters for administrative policymaking [19]. The Delphi technique is a method that reflects experts' point of view in developing a theory or validating idea on future inventions. The main motive of this technique is to acquire the utmost consistent consensus amongst the experts about particular issues. Delphi has been applied in various fields due to its reliability and usability.

Objective 3 was achieved with the formulation of Evaluation Model for assessing the effectiveness of coordination processes in GSD projects.

2.4. Phase 4

To achieve research objective four, the researcher chose case study.

Research Objective 4: To evaluate the proposed Evaluation Model in the GSD environment.

Case studies investigate phenomena in their real-world settings, for example, new technologies, communication in GSD, project risk and failure factors, and so on. Case study in software engineering is an empirical enquiry that draws on multiple sources of evidence to investigate one instance (or a small number of instances) of a contemporary software engineering phenomenon within its real-life context, especially when the boundary between phenomenon and context cannot be clearly specified [20-21], [22]. The purpose of a research study can be exploratory, descriptive, explanatory, or improving [20]. This research is an exploratory research. The reason is that exploratory research helps to clearly define the objective of the research and identify the main issues and the variables [21].

The rationale of undertaking this case study is, because of its suitability for examining a contemporary phenomenon in its real-life context [23]. A case study provides a focal point for understanding the phenomenon from many different perspectives. The case study is also one of the most common qualitative method used in software engineering, and many researchers have used the method in the area of GSD to develop and test new theory [22].

In this study, the proposed model was evaluated using a case study. Myers and Klein (2011) stated that there are three types of case studies in research, namely positivist, critical, and interpretative [24]. This study is more towards positivist case study, which searches for confirmation of model evaluation related to the effectiveness of the proposed model and model usefulness from selected GSD projects.

Finally, the report of the case study shows the effectiveness of the proposed Evaluation Model towards GSD project success, and the model is useful for GSD projects which fulfilled objective 4.

3. Results and Discussion

A total of 35 coordination strategies and 138 indicators were finalized after going through all the four phases. Table 1 shows the example of coordination strategies and indicators list according to the Coordination Process identified in this study. Each indicator is assigned its own indicator ID.

Table 1. Example of coordination strategies and indicators list.

No	Coordination Strategy	Indicator ID	Indicator Name
	CP6 Onsite Visit		
90	Training	O1	Type of cultural training
91		O2	Type of gender
92		O3	Business Needs
93		O4	Team Knowledge
94	Backup Team	O5	Type of cultural training
95		O6	Type of gender
96	Project Phases	O7	Emphasis on aligning with the solution
97		O8	Having the Requirement right
98	Planning the Visits	O9	Total Travel time
99		O10	Numbers of sites
100		O11	Type of communication methods
101		O12	Number of team members
102		O13	Total Cost for travelling to another site
103		O14	Gain experience
104		O15	Total number of meetings with stakeholders
		O16	Type of Skills

4. Conclusion

This paper provided a detailed description of the research methodology that the researcher undertook throughout the study. Justifications for the choice of research philosophy, research design, and research methods that were adopted and applied were explained. It explained each method in generic on how the

whole research was conducted. The rationale for selecting each method into this research was also explained.

Acknowledgement
The authors would like to thank Multimedia University, Universiti Teknologi Malaysia and other individuals for their kind support.

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