Chapter 1

Introduction to GSD and Research Issues

1.1 THE PHENOMENON: GSD

Global software development (GSD) is a software development that uses teams’ from multiple geographic locations (Sangwan et al. 2006). The working locations of these teams are commonly referred to as sites or development sites. Moreover, GSD has primarily different names for unique software development technique namely distributed software development and outsourcing technique in which the clients obtain services from a remote organization known as a service provider or vendor. Offshore Software Development Outsourcing (OSDO) is a current business strategy for developing high quality software system in the low wage countries at low cost (Khan et al. 2010).

In addition, OSDO describes the transfer of information system services (business process) from one country to another. GSD is primarily an outsourcing technique in which the on-site teams’ worked in the client location, understood, and audited the client requirements whereas offshore teams, operating from India, executed the requirement based on the inputs provided by the on-site teams.

1.2 CHALLENGES AND BENEFITS OF GSD

The companies are shifting to GSD paradigm to gain various benefits: to reduce cost, time and to improve the quality etc., Consequently, GSD is facing a number of challenges such as communication breakdown (loss of communication richness), coordination breakdown, control breakdown (geographical dispersion), cohesion barriers (loss of “teamness”), and culture clash (cultural differences). Moreover, the root cause of these challenges in GSD projects has been identified through extensive literature study (Päivi Parviainen et al. 2012) as shown in Fig1.1.

According to Päivi Parviainen (2012), the root causes of GSD challenges are classified under three causes: (i) basic GSD circumstances (ii) derivative GSD causes and (iii) consequent causes.
In this thesis, the root causes of these challenges have been addressed with respect to the outcome of GSD projects. The following section will elaborate the challenges and benefits associated with GSD projects.

1.2.1 BASIC GSD CIRCUMSTANCES

*Time difference and distance:* It is caused by the geographical distribution of the parties. However, time difference may not always be present in distributed development if the parties are in the same or in nearby time zones.

*Multiple parties:* This is with regard to two or more different teams and sites (locations) of a company or different companies. When multiple parties are involved, different working cultures and backgrounds usually play a role.

1.2.2 DERIVATIVE GSD CAUSES

*Lack of communication:* Communication is difficult in the geographically distributed development because of the time-zone difference. Moreover, arranging face-to-face meetings are complicated and expensive.

*Coordination breakdown:* Dividing and coordinating the tasks and work across development sites is difficult due to the restraints in the available resources, differences in levels of expertise and infrastructure.

*Different backgrounds:* It may imply that the ways in which people from different backgrounds work together as a team. Since different backgrounds involve different tacit knowledge it may leads to misunderstandings and wrong assumptions.

1.2.3 CONSEQUENT CAUSES

*Lack of teamness (teamwork):* It refers to a lack in the creation and maintenance of a common bond and identity in a team. Teamness helps a team to work better together as it improves co-operation and commitment to the team’s goals. Different processes, practices, and cultures tend to diminish teamness.

*Lack of trust:* It refers to mistrusting partners, manifesting an unwillingness to help each other and the placing of blaming instead of working together towards a common target.
1.2.4 GSD PARADIGM BENEFITS

The survey of existing study report (Conchuir et al. 2009) stated the benefits of GSD as shown in Table 1.1.

<table>
<thead>
<tr>
<th>Assumed Benefits</th>
<th>Extent to which realized</th>
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<tbody>
<tr>
<td><strong>Reduced Development Costs</strong></td>
<td>• Eight-fold developer salary difference Eg. US and India.</td>
</tr>
<tr>
<td></td>
<td>• Only lower value-add, less complex and mission-critical tasks being off-shored.</td>
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<td></td>
<td>• Significant overhead in communication, coordination and control overhead – e.g. buddy program.</td>
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<tr>
<td><strong>Leveraging time-zone Effectiveness</strong></td>
<td>Time-zones not a benefit but a cause of reduced collaborative time window and unusual working hours. Follow the sun not used for development activities, but sometimes for other activities, such as testing.</td>
</tr>
<tr>
<td><strong>Cross-site modularization of Development Work</strong></td>
<td>Modularization of work due to geographical distribution of developers can be effective in reducing the required level of cross-site communications. Might also be an obstacle to the creation of a sense of cross-site teamness.</td>
</tr>
<tr>
<td><strong>Access to large skilled labor pool</strong></td>
<td>GSD does provide access to large pool of skilled</td>
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workers. Extremely high attrition levels in rapid growth regions. Not all the desired skill-sets may be readily available. Socio-cultural problems abound.

<table>
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<tr>
<th>Innovation and shared best practice</th>
<th>Employees who feel threatened by low-wage colleagues are unlikely to share more than necessary to get the job done.</th>
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Table 1.1: GSD Benefits

In this thesis, the following benefits (see Table 1.1) are addressed in GSD projects derived by offshore/on-site teams’ partnership quality and service climate aspects with relation to the outcome of GSD projects.

1.3 PARTNERSHIP QUALITY AND SERVICE CLIMATE

In this research, partnership quality and service climate aspects are addressed from the perspective of OB research on GSD teams. Partnership quality and service climate definitions are given below according to the earlier studies.

**Partnership Quality:** Lee and Kim (1999) have defined as to “how well the outcome of a partnership delivered matches the participants’ expectations”. In addition, partnership quality is defined as ‘an inter-organizational relationship to achieve shared goals of the participants’ (Lee J. 2001).

**Service Climate:** Service climate refers to, IT professionals’ shared perceptions of the practices and behaviors in their workplace that support the provision of IT service to business customers (Jia Ronnie et al. 2008).

1.4 RESEARCH MOTIVATION

Accordingly, the market size has been growing in the past few years, with India becoming the most popular offshore destination (Markus Westner and Susanne Strahringer 2010). Offshore and on-site teams having extensive experience, showcase their potential in dealing with global customers. Moreover, the large number of companies using information system offshore is not satisfied with the outcome
(Markus Westner and Susanne Strahringer 2010). In this scenario, specifically, it should be noted that Indian software and service companies ensure the successful outcome of GSD projects on the basis to evaluate the GSD team’s partnership quality (on-going relationship) and team-level service climate. Subsequently, number of researchers have observed partnership quality as an important determinant of outsourcing success (Kedia and Lahiri 2007; Han et al. 2008; Cui et al. 2009; De-Vita et al. 2010). Moreover, existing studies investigated the partnership quality from service provider and service receiver point of view in a mature relationship. It is a clear indication that there have been no existing studies that investigated the GSD teams’ partnership quality in the context of GSD project outcome.

The theoretical basis for studying the phenomenon of GSD draws upon one of the important research streams which is Organizational Behavior (OB) research on collaboration with Globally Distributed (GD) teams that examines the importance of social aspects in global collaborations. In addition, Social Exchange Theory (SET) is applied to understand the outsourcing decisions and outcomes (Hui and Beath 2001). However, a clear deviation can be observed in the performance indicators applied in different studies based on the grounded theory. Specifically, this thesis which is based on the SET perspective may help in comprehending IT outsourcing relationship and it also investigates the significance of partnership quality, service climate aspects with respect to the outcome of GSD projects in different settings.

Earlier studies (Gorla et al. 2010; DeLone et al. 2003; Pitt et al. 1995) emphasized that IT service quality has significant impact on the organizational performance along with information quality and system quality. Moreover, Jia Ronnie (2013) reported that IT service climate aspects have been the key predictors to create a major impact on IT service quality. Subsequently, many studies (Gorla et al., 2010; Kettinger et al., 2005; Jiang et al., 2002) have been presented as quality measures for investigating the relationship between service climate and service outcome. Based on this context, this thesis investigated that GSD team-level service climate has been a key predictor of IT service quality with respect to GSD project outcome/success in the software service outsourcing context.
The research work reported in this study, proposes a framework to analyze the influence of GSD teams’ partnership quality and service climate aspects with relate to the GSD project outcome. In this research, analysis is performed on the basis of three major approaches namely: statistical, neuro-fuzzy, and neuro-fuzzy-genetic learning approaches. This thesis suggests that these approaches have been widely used by the industries effectively to evaluate and to make a reliable prediction of GSD teams’ partnership quality and team-level service climate in GSD projects.

1.5 RESEARCH OBJECTIVES AND QUESTION

This thesis aims to develop a comprehensive methodology for measuring offshore/on-site teams’ partnership quality and service climate aspects in the context of the GSD project outcome. For this thesis, I have specified the following research objective:

**Research objective:** To explore how GSD teams’ partnership quality and service climate aspects may be created and to investigate their effect on GSD project outcome.

This forms the basis for two research problems:

1. Under what circumstances do the knowledge sharing, trust, commitment, and requirements flow down between GSD teams? (RQ-1)
2. How do GSD teams’ partnership quality and service climate aspects create a significant impact on GSD project outcome? (RQ-2)

To answer these research questions (RQ-1 & RQ-2), the following objectives are undertaken:

1. To build a unified and theoretically grounded research model which specifies the different dimensions of GSD teams’ partnership quality and underlying the influencing factors that contribute the outcome/success of GSD projects.
2. To propose FMCDM framework for an effective assessment of the GSD teams’ partnership quality dimensions, underlying influential factors and their impacts on success of GSD project outcome under fuzzy environment.
3. To measure the IT service quality through the lens of offshore/on-site team-level service climate and GSD project outcome relationship on the basis of FMCDM approach combined with genetic-algorithm (GA) based approach.

4. To propose a Neuro-fuzzy learning approach with fuzzy inference system (FIS) design for evaluating GSD team-level service climate from the perspective of GSD project outcome.

5. To evaluate the offshore/on-site team-level service climate in GSD projects on the basis of adaptive neuro-fuzzy inference system (ANFIS) with hybrid taguchi-genetic learning algorithm (HTGLA). HTGLA based ANFIS is adopted because it is more appropriate to determine the optimal premise and consequent constructs by reducing the root-mean-square-error (RMSE) and improve the prediction accuracy of service climate criteria.

Based on the results of the empirical investigation, the theoretical lens is revised and an exploratory framework is proposed. Furthermore, Neuro-fuzzy-genetic approaches describe that how effectively the GSD teams’ partnership quality and service climate aspects in the context of GSD project outcome relationship are evaluated and presented.

1.6 PROBLEM DESCRIPTION

It is evident from the existing studies that no prior research and framework has been developed for the purpose of evaluating the influence of GSD teams’ partnership quality and service climate aspects with relation to the outcome of GSD projects. Therefore, it is necessary to develop a framework addressing both GSD teams’ partnership quality and service climate aspects. Especially, a number of studies have focused on partnership quality, service climate aspects from service provider and service receiver point of view and have evaluated using the conventional statistical methodologies. Moreover, there has been an interest to use learning and adaptation approaches through a combination of other techniques (e.g. fuzzy system-neural networks, fuzzy system-genetic algorithms).

In this thesis, it should be noted that, to the researchers’ best knowledge, there are no existing studies that investigated the GSD teams’ partnership quality and service climate on the basis of neuro-fuzzy approach. Hence, the aim of this thesis is
to propose a framework for assessing GSD teams’ partnership quality and service climate aspects based on statistical approach, fuzzy-genetic and neuro-fuzzy approaches in terms of improving the prediction accuracy. Throughout this thesis, the significance of GSD teams’ partnership quality and service climate aspects has been studied for GSD project outcome based on OB research and IS literature.

1.7 FOCUS OF THIS THESIS

The focus of this research is on the GSD teams’ partnership quality and service climate aspects of GSD projects, as described in Fig 1.2. The main focus of this thesis is organizational Behavior (OB) research on partnership quality (collaboration in global distributed teams) of GSD teams’ that reveals the significance of social aspects in GSD environment.

(a) GSD team’s partnership quality was analyzed based upon social exchange theory elements. Satisfaction was measured with the outcome of the GSD project from the service provider perspective into three dimensions: product success, successful collaboration, and personal satisfaction.

(b) To improve the customer service quality, shortening the development cost and schedule are mentioned as objectives for motivating GSD project outcome initiatives, thus assessing GSD teams’ partnership quality on GSD project outcome.
outcome relationship at Indian software organizations. This thesis suggests a framework based on the FMCDM approach for evaluating the GSD teams’ partnership quality towards the outcome of GSD projects.

(c) To measure the IT service quality criteria on this basis of FMCDM-GA approach to evaluate the team-level service climate of GSD teams’ in the software service outsourcing context.

(d) The intention is to capture the benefits of Neuro-fuzzy approach and build a powerful framework for decision-making systems on this basis to evaluate the GSD team-level service climate with respect to the outcome of the GSD projects according to ANFIS approach.

(e) To propose a HTGLA-based ANFIS approach that provides an accurate and reliable prediction of team-level service climate when compared to the existing approaches, (FMCDM with genetic algorithm learning approach, ANFIS and statistical methods) in terms of prediction accuracy.

1.8 RELEVANCE AND CONTRIBUTIONS TO THE RESEARCH

This research is carried out on the basis of three main theoretical contributions and more relevance to OB research on GSD teams’ which addresses the significance of social aspects for the success/outcome of GSD projects. In the context of OB research, this thesis presents an integrated view on the phenomenon of GSD teams’ which combines the following areas of research:

(a) GSD teams’ partnership quality in GSD projects: A theoretical framework that analyzes the influence of partnership quality factors contributing to the success of GSD project is proposed on the basis of conventional statistical methodology and FMCDM approach.

(b) Measuring IT service quality in the context of TSC and GSD project outcome relationship: FMCDM-GA based approach is proposed for measuring IT service quality in the context of team-level service climate and GSD project outcome relationship.

(c) Evaluate team-level service climate in the context of GSD project outcome: Evaluation through combining Neuro-fuzzy and Genetic learning approaches
(ANFIS, HTGLA-ANFIS) in order to improve the prediction accuracy of service climate aspect is presented.

1.9 ORGANIZATION OF THE THESIS

This dissertation is organized in nine chapters and the structure of the thesis and research design is presented in Fig 1.3.

Figure 1.3: Thesis Structure and Research Design
Chapter-1 presents an overview of GSD phenomenon, research motivation, objectives, problem description, and focus of the thesis. Chapter-2 provides a detailed literature survey relevant to research on the GSD teams. Based on this literature review, the research framework is developed. The research framework, presented in Chapter-3, explores the GSD teams’ partnership quality factors contributing to the success/outcome of GSD projects and it serves as a theoretical lens for empirical study.

Chapter-4 explains the research process and specific techniques that are used for data analysis and instruments and Chapter-5 deals with the FMCDM approach for evaluating the outcome/success of GSD projects under fuzzy environment. Chapter-6, measuring the IT service quality in the context of team-level service climate and GSD project outcome relationship is presented. The performance (prediction accuracy) of developed framework for assessing the team-level service climate in the context of GSD projects is evaluated by comparing it with ANFIS and HTGLA based ANFIS and it is elaborated in Chapter-7 and Chapter-8. Finally, the conclusion, future work, case study analysis, and results of the thesis are presented in Chapter-9.

1.10 SUMMARY

Chapter 1 presents an overview of the research issues, challenges, benefits on GSD projects and identified the research gaps in the GSD phenomenon that motivated, focused in this thesis is presented. Finally, the thesis structure, research design contribute towards the research objectives are addressed.