Chapter 1
Introduction to GSD Projects and Research Challenges

1.1 THE PHENOMENON: GSD PROJECTS

Global software development (GSD) projects use software development teams in distributed locations to achieve the successful outcome of software systems. In addition, GSD is a knowledge intensive process of offshore/onsite teams that helps in planning and designing a coherent software system to meet business needs. The aim of this research is to reveal the influence of GSD teams’ (offshore/onsite) knowledge transfer (KT) effectiveness dimensions on software process improvement (SPI) in ensuring laudable outcome of GSD projects. In the GSD projects, where offshore/onsite teams’ are distributed and working in various geographic locations, the process of knowledge transfer/codification is influenced by several factors. Thus, the objective of this research is to address the knowledge transfer effectiveness dimensions in the context of GSD project outcome and SPI perceived by GSD teams. This thesis also explores to integrate effectiveness of knowledge transfer and process improvement in GSD project outcome relationship from the service provider perspective in the following dimensions: product success, successful collaboration, and personal satisfaction.

GSD is primarily an outsourcing technique in which on-site teams’ are working in the client location, understanding, and auditing the client requirements. Whereas, offshore teams operating at different regions, execute the requirements based on the inputs provided by the on-site teams (Sangaiah and Thangavelu (2013)). In today’s world GSD teams’ (offshore/on-site) knowledge transfer (KT) factors have created a significant impact on software process improvement relating to the outcome of GSD projects. Subsequently, the earlier literature García-Muiña et al. (2009); Albino et al. (2001); Prencipe and Tell (2001) on the knowledge management theory reveals the role of knowledge transfer factors and their significant impact on project success. However, earlier studies (Syed-Ikhsan and Rowland 2004; Kang et al. 2010; Susanty et al. 2012) on knowledge management theory has been focused on the relationship between organizational elements and performance of knowledge transfer. In addition, many studies (Aziati et al. 2014; Sangaiah and Thangavelu 2013; Al-
Saltiand Hackney 2011; Beulen et al. 2011; Mohamed et al. 2009) reveal the significance of success of knowledge transfer in Information System (IS) outsourcing.

Knowledge Transfer effectiveness dimension among GSD teams’ have not been sufficiently investigated despite their importance in software process improvement. In this research, the aim is to overcome the limitations of earlier studies which only investigated the effects on the success of knowledge transfer. Thus, this research explores a deeper insight into the codification factors on GSD teams’ knowledge transfer effectiveness at individual (team and knowledge context) and organizational levels (technology and organization context) relating to the process improvement in GSD projects.

1.2 SOFTWARE PROCESS IMPROVEMENT

In this research, knowledge transfer effectiveness factors have been addressed from the perspective of PSP, TSP in SPI on GSD teams as shown in Fig.1.1. PSP and TSP definitions are described below based on the earlier study by Humphrey (1989).

**Figure.1.1**: Software Process Improvement Dimensions
**Software Process Improvement (SPI):** Set of activities, methods, practices, and transformations that developers use to develop and maintain information systems (Humphrey 1989).

**Personal Software Process (PSP):** PSP is a structured software development process that is intended to help software engineers understand and improve their performance by tracking their predicted and actual development of code (Humphrey 1989).

**Team Software Process (TSP):** TSP is a guideline for software product development teams. TSP focuses on helping development teams to improve their quality and productivity to meet goals of cost and progress better. (Humphrey 1989).

### 1.3 RESEARCH MOTIVATION

The research work reported in this thesis, proposes an assessment framework for analyzing the impact of GSD teams’ KT aspects on SPI relating to the GSD project outcome. In this thesis, analysis has been performed on the basis of statistical approaches and fuzzy set theory. This thesis also indicates the extensive use of the proposed assessment framework by software organizations effectively to evaluate and to make a reliable prediction of GSD teams’ KT aspects in global settings.

### 1.4 RESEARCH OBJECTIVES AND QUESTIONS

This research aims to build a comprehensive methodology for evaluating the effectiveness of knowledge transfer in PSP, TSP in the context of the SPI and GSD project outcome perceived by GSD teams.

**Research objective:** To explore how GSD teams’ KT effectiveness aspects may be created and to investigate their effect on SPI relating to GSD project outcome. Based on this context, research questions being formulated as:

**RQ-1:** What are the factors that affect knowledge transfer in the context of GSD projects as reported in existing literature?
**RQ-2:** What are the effects of knowledge transfer on the factors affecting process improvement in the context of GSD project outcome?

To address these research questions (RQ-1 and RQ-2), the following objectives are focused in this thesis:

1. To explore SPI research on GSD projects that reveal significance of knowledge transfer effectiveness in GSD environment.
2. To address the knowledge transfer effectiveness under the SPI level of hierarchy, that is PSP, TSP of GSD teams in the context of the SPI and GSD project outcome relationship.
3. To investigate the influence of GSD teams’ knowledge transfer effectiveness at the individual and organization levels under SPI research phenomenon of GSD projects. For evaluating the teams’ knowledge transfer effectiveness in GSD projects, this research integrates the Fuzzy Decision Making Trial and Evaluation Laboratory (DEMATEL) and Fuzzy Multi-Criteria Decision Making (FMCDM) approaches.
4. To propose the assessment framework to evaluate GSD teams KT effectiveness with reference to GSD project outcome. For evaluating KT effectiveness of GSD teams, this research integrates three Fuzzy Multi-Criteria Decision Making (FMCDM) methodologies: (a) fuzzy Decision Making Trial and Evaluation Laboratory Model (DEMATEL) (b) Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) and (c) Elimination EtChoixTraduisant la REaite (ELECTRE).

An exploratory KT evaluation framework is proposed based on the research gaps. Furthermore, FMCDM approaches describe that how effectively assess and ranking the KT aspects with reference to SPI and GSD project outcome relationship has been presented in this research.

**1.5 PROBLEM DESCRIPTION**

It is evident from the earlier literature studies on KT effectiveness of GSD teams is not adequately available. Similarly, assessment framework has not been developed for the purpose of evaluating the KT effectiveness of GSD teams’ with relating to SPI and GSD project outcome. Hence, it is vital to build an assessment
framework addressing GSD teams’ KT dimensions. Earlier studies (Susanty et al. 2012; Kang et al. 2010; Syed-Ikhsan and Rowland 2004) have investigated the correlation between organizational elements and the performance of knowledge transfer. Consistent with the earlier literature, this research has integrated organizational elements and knowledge characteristics for the effectiveness of knowledge transfer perceived by GSD teams in the project outcome relationship in four contexts: knowledge, team, technology, and organization. However, the investigation of the factors affecting knowledge transfer effectiveness of GSD teams has not been investigated adequately despite their importance relating to SPI in GSD projects. Thus, this research explores a deeper insight into the factors of knowledge transfer effectiveness of GSD teams at individual (team and knowledge context) and organizational levels (technology and organization context) in relation to the SPI and GSD project outcome.

Prior studies have not reported a comprehensive framework that consider the four contexts of GSD teams for assessing knowledge transfer effectiveness with reference to SPI and GSD project outcome. Furthermore, it should be noted that to the best of knowledge, there are no earlier studies that integrated the GSD teams’ KT aspects and SPI on the basis of fuzzy set theory. Hence, the aim of this research is to propose an assessment framework for assessing GSD teams’ KT aspects on the basis of statistical approach, fuzzy MCDM approaches in terms of improving the decision making process. Throughout this thesis, the significance of GSD teams’ KT aspects, Software process improvement has been studied for GSD project outcome.

1.6 FOCUS OF THIS THESIS

The focus of this thesis is to address the GSD teams’ KT aspects and process improvement aspects of GSD projects, as described in Fig.1.2. It addresses software process improvement research on GSD projects that reveal the significance of effectiveness of knowledge transfer in GSD environment.

In order to study the GSD teams KT aspects, emphasis of the research work reported in this thesis is specified below and discussed in Chapter 3 to Chapter 6.
(1) To construct a unified and theoretically grounded research framework which addresses the different dimensions of GSD teams’ KT effectiveness dimensions and its underlying the influencing factors that may have a significant impact on process improvement and the outcome/success of GSD projects.

(2) To propose hybrid FMCDM approaches for an effective assessment of the GSD teams’ KT effectiveness dimensions, underlying influential factors and their impacts on SPI and success of GSD project outcome under fuzzy set theory.

(3) To measure KT effectiveness through the lens of SPI and GSD project outcome relationship on the basis of DEMATEL, TOPSIS, ELECTRE approaches.

![Figure 1.2: SPI Dimensions with reference to GSD teams KT Effectivnes](image)

1.7 ORGANIZATION OF THE THESIS

This dissertation is organized in seven chapters and the overview structure of the thesis presented as follows:

Chapter-1 gives an overview of GSD projects and SPI, research motivation, objectives, problem statement, and focus of the research. Chapter-2 provides a
comprehensive literature survey relevant to research on the GSD teams KT aspects. The research model and assessment have been formulated on the basis of the literature review. The assessment, framework is depicted in in Chapter-3, explores the GSD teams’ KT dimensions contributing towards the success/outcome of GSD projects and it serves as a theoretical lens for empirical investigation.

Chapter-4 explains the research process, research design and approaches for data analysis and measurements. Chapter-5 presents the FMCDM-DEMATEL approach for evaluating the KT aspects in the context of outcome/success of GSD projects under fuzzy set theory. Chapter-6 gives a detailed overview of Fuzzy DEMATEL-TOPSIS-ELECTRE approach to find the weights and ranking of KT effectiveness factors as well as significant role in decision making process. Finally, the conclusion, future work, and results of this research have been presented in Chapter-7.

1.8 SUMMARY

This chapter presents a clear picture of GSD project research issues and challenges and acknowledges the need for further research in SPI and GSD. Finally, the thesis structure, research process, the research objectives have been listed in this chapter.