



## **Investigation of Fuzzy Approaches for Software Process Improvements with respect to GSD Projects**

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### **Abstract**

Software Process Improvement (SPI) is a set of activities that lead to a better software process, ensuring higher quality software and timely delivery. The main focus of this paper is to address the SPI research on Global software development (GSD) projects that reveals importance of GSD teams' knowledge transfer effectiveness in the GSD projects. GSD projects have been knowledge intensive process of GSD teams' (offshore/onsite) that helps in planning and constructing a coherent software system to fulfil the organization needs. Moreover, GSD teams' knowledge transfer effectiveness is one of the major determinants for assessing the 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 effectiveness has been determined through various measurements: (a) knowledge, (b) team, (c) technology, and (d) organization factors. The main aim of this paper is to analyse the integration of above criterion in the context of knowledge transfer effectiveness in GSD project outcome relationship.

**Keywords:** *Software Process Improvement(SPI), Knowledge Transfer (KT), Global Software Development (GSD), Project outcome.*

### **1. Introduction**

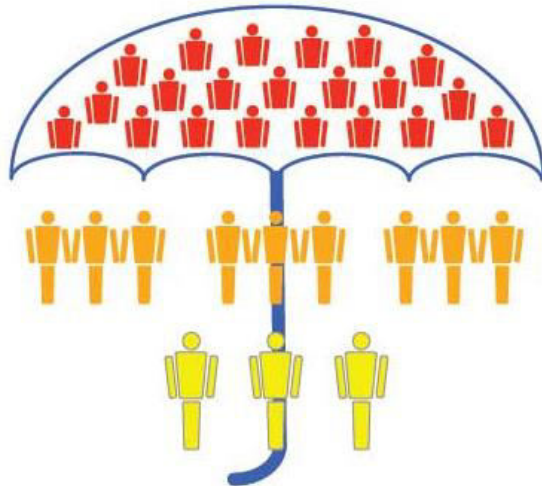


In software process improvement, the process has a three level hierarchy, where the lowest level is Personal Software Process (PSP) – which focuses on individuals, Team Software Process (TSP) - the focus is on the entire team and Capability Maturity Model (CMM) - focus is on entire management. Moreover, in this research knowledge transfer effectiveness criteria has been studied under PSP and TSP of GSD teams in the context of SPI to improve the level of software process in GSD projects. Furthermore, the evaluation framework for the integration of knowledge, team, technology, and organization factors for evaluating KT on SPI in GSD projects has not been adequately available in the existing literature. For this motivation, the main objective of this paper is to propose an assessment framework to evaluate offshore /onsite teams KT effectiveness on SPI with reference to GSD project outcome.

The limited literature exists on the fuzzy multi-criteria decision making (FMCDM) approaches for evaluating the SPI in GSD teams. Thus, the need to address these research gaps inspired to explore and study the various fuzzy approaches and its significance has been addressed in this paper. The applicability and capability of proposed assessment criteria has been validated by software experts at a Software Organization in India. The results of this research also address that knowledge, team, and technology context factors have a positive impact on KT effectiveness and play a mediating role of relationship in SPI and GSD project outcome.

### **1.1 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. PSP and TSP definitions are described below based on the earlier study by Humphrey (1989).



**CMM:** Improves organization's capability;  
Management focus

**TSP:** Improves team performance; Team and  
Product focus

**PSP:** Improves individual skills and discipline;  
Personal focus

#### 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).

## 2. Research Question

The research work would be planned in this paper, proposes an evaluation methodology for analyzing the impact of GSD teams' KT aspects on SPI relating to the GSD project outcome. This paper 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 for SPI in global settings.

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. To achieve this we have specified the following research objectives:

**Research objective:** To explore how knowledge, team, technology organizational-related factors are classified with respect to the SPI dimensions on GSD teams. This forms the basis for following research questions:

**RQ 1:** What are the factors that affect the SPI in the context of GSD projects as reported in existing literature?

**RQ 2:** What are GSD team KT factors affecting a SPI from a GSD project outcome perspective?

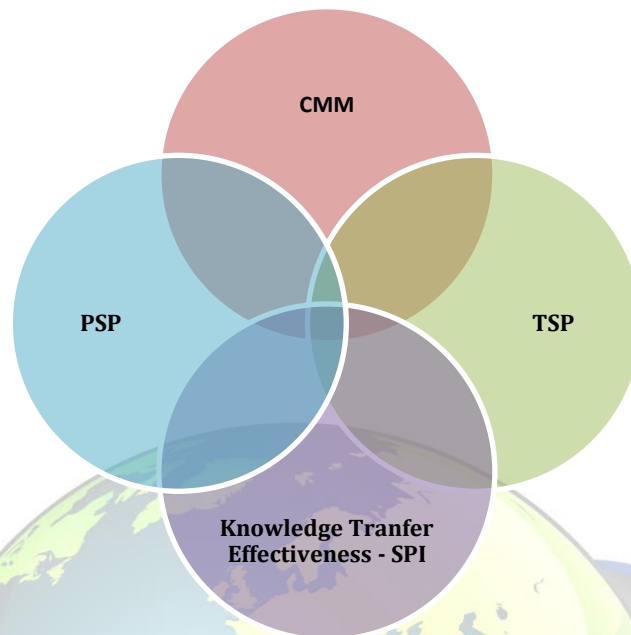
To reveal this research questions the empirical study would be planned to analyze the KT effects on SPI perceived by GSD teams. The rest of this paper is outlined as follows: Section 3 presents the overview of proposed work and Section 4 presents the methodology and conclusion of the study respectively.

### 3. Overview of Theoretical Foundation

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

1. To analyse SPI research on GSD projects that address the impact of knowledge transfer effectiveness in GSD settings.
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 as shown in Fig.2.



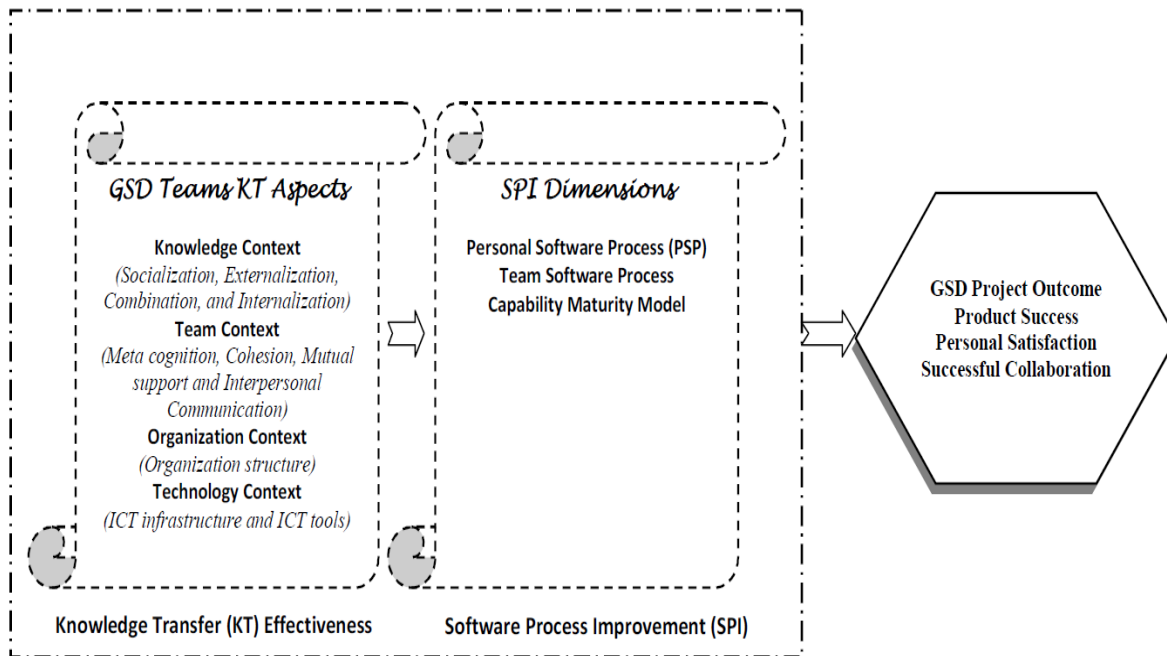


**Figure.2:** SPI Dimensions with reference to GSD teams KT Effectivnes

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 incorporated Fuzzy Multi-Criteria Decision Making (FMCDM) approaches.

### 3.1 Research on Software Process Improvement in SD Projects

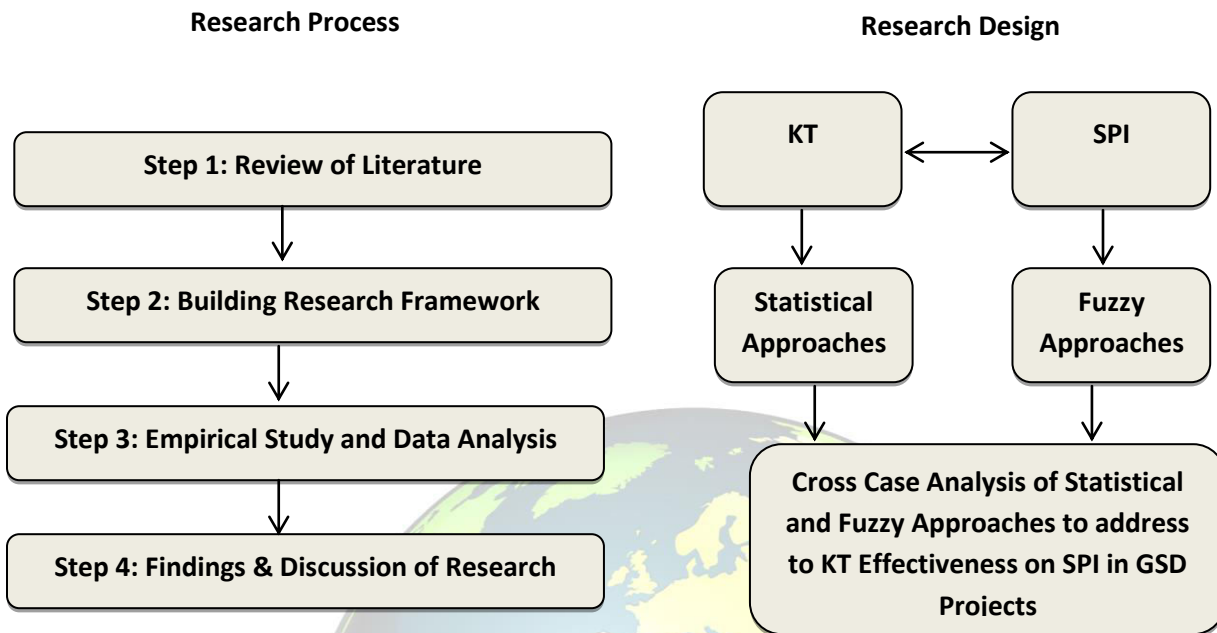
Software process improvement plays an important role in helping project teams in software development organizations. Moreover, previous studies (Sangaiah et al., 2017; Kumar and Thangavelu 2012; Al-salti and Hackney 2011; Mohamed et al. 2009; Nidhra et al. 2013; Aziatiet al. 2014; Kumar and Ganesh 2009; Sangaiah et al., 2015; Sangaiah et al., 2014; Sangaiah et al., 2013; Gopal et al., 2015; )have addressed the characteristics of knowledge and significance of knowledge transfer in IS outsourcing success.



**Figure 3:** The GSD teams' KT effectiveness Dimensions: Significant Impact towards SPI and GSD project outcome.

Moreover, previous researchers (Syed-Ikhsan and Rowland 2004; Kang et al. 2010; Susanty et al. 2012) have addressed the significance of individual and organizational knowledge for effectiveness of knowledge transfer. Moreover, earlier researchers Miklos Biro and BalintMolnar 2007) have discovered between the ISO/IEC 15408(common criteria)IT Security Evaluation Standard, software product quality evaluation standards and the CMMI. In addition, the significance of SECI (Socialization, Externalization, Combination, and Internalization) in knowledge management theory is acknowledged in a substantial measure of available literature. Based on the available literature the GSD teams' KT effectiveness factors may significantly impact towards the SPI and success/outcome of GSD projects as shown in Figure. 3

The research design and respective research process steps are shown in Fig4. The first step in the research process involves a review of related literature in the context of offshore/onsite teams' KT effectiveness on SPI on GSD projects



**Figure 4.:**The research process and research design

Research framework has been formulated on the basis of the literature review. An empirical study would be carried out for collecting data and analysis was performed. Data analysis has been done thorough statistical and Fuzzy approaches (step 3). Finally, the results from the various approaches reveal the research question ‘*How do knowledge transfer effectiveness factors are significant for GSD project in the context of SPI?*’ would focused in the future work 4.

#### 4. Conclusion

The earlier research gaps on knowledge transfer effectiveness on SPI in GSD projects have been carefully studied. The main contribution of this research focused on integrating SPI dimension for with relate to GSD project outcome. In this process, this study integrated a set of measures on knowledge, team, organization, and technology context for SPI in GSD projects. Moreover, to address relationships and effects on GSD teams’ KT effectiveness with relate to SPI in GSD projects needs further research.



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