Towards a Hypothetical Framework of Humans Related Success Factors for Process Improvement in Global Software Development: Systematic Review

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ABSTRACT
Presently, the majority of the software development organizations are adopting the phenomena of Global Software Development (GSD), mainly because of the significant return on investment it produces. However, GSD is a complex phenomenon and there are many challenges associated with it, especially that related to Software Process Improvement (SPI). The aim of this work is to identify humans' related factors that can positively impact the SPI process in GSD organizations and proposed a hypothetical framework of the identified success factors in relation to SPI implementation. We have adopted the Systematic Literature Review (SLR) method in order to identify the success factors. Using the SLR approach, total ten success factors were identified. The paper also reported the Critical Success Factors (CSFs) for SPI implementation following the criteria of the factors having a frequency ≥ 50% as critical. Our results reveal that five out of ten factors are critical for SPI program. Based on the analysis of the identified success factors, we have presented a hypothetical framework that has highlighted an association between the identified success factors and the implementation of the SPI program in GSD environment.

CCS Concepts
•CCS → **Software and Its engineering→ Software creation and management → Software development process management→ Software development methods→ Capability Maturity Model**

Keywords
Software Process Improvement; Systematic Literature Review; Human; Global Software Development

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1. INTRODUCTION
Software process improvement (SPI) provides an organization with a commanding means of evaluating their abilities to improve the software development process; accordingly, this practice allows organizations to identify their strengths and weaknesses. Zahran [1] defined SPI as "the discipline of defining, characterizing, improving, and measuring software management, better product innovation, faster cycle times, greater product quality, and reduced development costs simultaneously." Different standards and models for SPI have been developed, each of which assists organizations in optimizing their software processes through evaluation of process efficiency. Khan and Keung [5] mentioned that the failure rate of SP programs is 70%, and one of the ground reasons of this failure is the inadequate attention given to process improvement problems.

Various process improvement models and standards have been developed in order to bring software development firms towards improving their development processes and instruments are designed to assess the strength of the process. Capability Maturity Model Integration (CMMI) [3] is one of process improvement models that have been developed. CMMI is a process model framework for SPI. It is organized, systematic and control collection of the best practices for process improvement and assessment. In addition to this, International Organization for Standardization (ISO) also started the development of software process assessment standards. The ISO 9000 was developed by ISO and is used to assess the quality of the deployed software systems in an organization [3].

However, slight consideration has been given to develop process improvement models and standards in the context of GSD, which has resulted in limited success for many SPI activities [3]. GSD is the plan of action in which the software development is performed beyond the geographical, cultural and temporal boundaries [5]. Ramasubbu [4] reported that most of the available literature discussed SPI in the context of collocated (single site) software development, but currently the majority of organizations are adopting the phenomena of GSD. Khan and Keung [5] and Ramasubbu, [4] discussed that development teams working in GSD operate from various geographical boundaries, which makes communication and collaboration

more difficult and the need for implementation of a process improvement program is much pronounced.

Regardless of the significance of process improvement program, slight attention has been given towards the development of methods and techniques in general and findings of factors that can affect the implementation of process improvement in GSD organizations in particular [3, 4, 5]. Consequently, the increasing importance of SPI in GSD motivated us to develop an initial Software Process Improvement Implementation Management Model (SPIIMM) that could assist GSD organizations to measure and improve their software process improvement activities related to humans. An initial step towards the development of this model is discussed in this paper. In this article, we identified the success factors that could have a positive impact on humans' related aspects of the SPI program in GSD environment. According to Komiyama [10] "all personnel must be interested in the process, as the success of software projects depends on processes". Small and medium size organizations were believed to be mostly dependent on human factors as they usually relied on key individuals [10]. Therefore, small and medium size organizations should properly manage the success factors reported in the domain of human category.

In this article, we present results from our Systematic Literature Review (SLR) study and provide an in-depth understanding of the success factors that perform an important role in the implementation of SPI activities related to humans in distributed software development. Understanding of these factors can address the key area for SPI implementation and it will assist the practitioners to consider these factors prior to process improvement implementation. For this reason, this study will answer the following research questions.

RQ1: What are the humans related success factors, as identified in the literature, do GSD organizations need to address in order to have a positive impact on the SPI implementation?

RQ2: What are the most critical humans related success factors that could impact SPI in GSD?

RQ3: How to develop a hypothetical framework for humans related success factors of SPI?

2. RESEARCH METHODOLOGY

Systematic literature review (SLR) method was selected in order to conduct this research study. An SLR is a secondary study that reviews all primary studies (i.e., those that explore a specific research area), identifying, analyzing, and exploring all evidence related to research questions in an unbiased and iterative way [2]. Kitchenham and Charters [2] classified SLR into three main phases: planning the review, conducting the review and reporting the review.

2.1 Planning the Review

In the first phase of the review, the SLR protocol was developed. SLR protocol provided the complete guideline to develop the research questions, search process, inclusion and exclusion criteria, articles selection, publications quality assessment and data extraction [2].

2.1.1 Research Questions

The research questions developed for this study are discussed in section 1.

2.1.2 Search Process

A comprehensive search process was conducted in order to classify all the available research articles relevant to our questions of interest.

For the search process, the keywords and their alternatives were chosen based on the available literature in the domain of SPI [3, 4, 5, 12]. The major keywords and their alternate words were concatenated with the help of "OR" and "AND" operators that were later used in different databases to identify the relevant primary studies.

The following search strings were developed and used in several databases in order to identify the relevant articles.

("Factors" OR "Aspects" OR "Items" OR "Elements" OR "Drivers" OR "Motivators" OR "Variables" OR "Characteristics" OR "Parameters") AND ("GSD" OR "global software development" OR "global software engineering" OR "distributed software development" OR "software outsourcing" OR "offshore software development" OR "information technology outsourcing" OR "software contracting-out" OR "IT outsourcing") AND ("SPI" OR "software process improvement" OR "software process enhancement" OR "CMM" OR "CMMI" OR "SPICE" OR "software process enrichment" OR "software process evaluation" OR "software process assessment" OR "software process appraisal")

Databases were chosen based on prior research experience, literature background and suggestions provided by other researchers [6]. Total five databases were selected, i.e., IEEE, Scopus, Google Scholar, Science Direct and ISI Web of Science.

2.1.3 Inclusion and Exclusion Criteria

Each selected article must be written in English and available in full text version. These articles must be conferences, journals, workshops, books articles and thesis. We have considered the studies which emphasized on process improvement activities in the distributed software development environment. More effort was put on the research studies that are discussing humans related success factors for SPI in GSD.

The articles that did not explicitly discussed the success factors for SPI in the context of GSD were excluded from this analysis. Duplicates of the same results were also excluded. Further exclusions have been made in those studies that were written in a language other than English

2.1.4 Study Quality Assessment

Quality assessment assists to interpret the results and to determine the strength of the elaborated inferences [2]. The guideline provided by [7] was adopted to formulate the Quality Assessment (QA) criteria for the evaluation of the selected primary studies. The check list shown in Table 1 was used to assess the quality of each selected study.

The checklist consists of total five QA questions from QA1 to QA5. For each QA question, the assessment was carried out as follows:

- The studies containing answers to the checklist questions were given a score of 1 point.
- The studies containing partial answers to the checklist questions were given score of 0.5 points.
- The studies not containing any answer to the checklist questions were given score of 0 points.

Table 1. Study Quality Assessment Criteria

QA Questions	Checklist Questions
QA1	Do the adopted research methods address the research questions?
QA2	Does the study discuss any success factors and practices for SPI?
QA3	Does the study discuss SPI implementation standards and models?
QA4	Is the collected data related to SPI?
QA5	Are the identified results related to justification of the research questions?

We have also evaluated the quality of the selected primary studies against each quality assessment question discussed in Table 1. The QA score for each primary study is shown in Appendix 1.

2.2 Planning the Review

2.2.1 Articles Selection

The SLR protocol search strings (Sect. 2.1.2) were applied and a total of 2174 articles were extracted from all the selected databases. The tollgate approach proposed by Afzal [8] was used in the articles selection process. Tollgate technique consists of five steps and each digital data source was exclusively evaluated against these five steps as shown in Table 2.

- St-1: Search through search terms
- St-2: Inclusion/exclusion based on title and abstract
- St-3: Inclusion/exclusion based on introductions and conclusions
- St-4: Inclusion/exclusion based on full text
- St-5: Final selected studies to be included in the SLR study

After applying the tollgate approach, we have identified total 19 articles that focused on SPI in GSD.

Table 2. Tollgate Approach

SD	St-1	St-2	St-3	St-4	St-5	% of final selected articles (n=19)
WI	25	24	17	11	4	21
IE	461	390	135	76	5	26
AC	560	511	194	117	1	5
SP	146	112	37	25	3	16
ScD	502	673	232	154	4	21
GS	480	430	176	86	2	11
TL	2174	2140	791	469	19	100

SD=Selected Databases, WI= Wiley Inter Science, IE= IEEE Xplore, AC=ACM Digital Library, SP=Springer Link, ScD=Science Direct, GS=Google Scholar, TL=Total, n= total no of selected primary studies

2.2.2 Data Extraction

We extracted the title of each primary study and QA score for each article. A complete list of all the selected 19 primary studies is provided in Appendix 1.

3. REPORTING THE RESULTS

Using SLR approach, we have identified total ten success factors in the domain of human category. This section reports the results of the success factors in relation to each of the research questions.

3.1 RQ1

Grounded theory-based coding approach [9] was adopted which provides qualitative and analytical approach in which concepts (factors) are labeled and categorized through the close examination of qualitative data. We have used grounded theory-based coding approach [9] to review the selected 19 primary studies, conceptualize the underpinning factors and assign a label (name) to each factor. Similar or related factors are semantically compared and grouped in the human category.

Therefore, applying the grounded theory-based coding approach enabled us to identify humans' related category of SPI and classified the identified ten success factors across this category.

The following are the identified ten success factors as shown in Table 3, Figure 1 and briefly discussed thereafter.

Table 3. Identified Success Factors

S.No	Success Factors	Frequency	% of occurrence
SF1	Management Commitment	16	84
SF2	Staff Involvement	14	73
SF3	Strong Relationship	9	47
SF4	Information Sharing	8	42
SF5	SPI Expertise	6	32
SF6	Roles and Responsibilities	11	58
SF7	SPI Leadership	10	53
SF8	SPI Awareness	7	37
SF9	Skilled Human Resources	12	63
SF10	3C's (Communication, coordination and control)	5	26

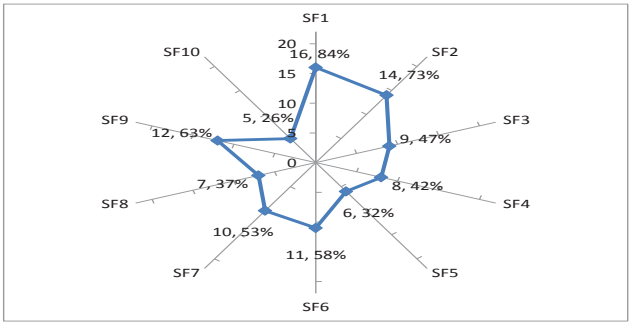

Figure 1: Frequency analysis of the identified success factors

3.1.1 Management Commitment (SF1)

Most of the SPI literature focused on the importance of organizational management support for SPI [LT1]. The

organizational management commitment plays a significant role in order to successfully execute the SPI activities. Sulayman et al [LT2] define management commitment as "the degree to which the higher and lower level management in an organization financially support, realize and involved in SPI activities". Hall et al [LT1] demonstrate the importance of management commitment through an empirical study. In particular, they reported that when the SPI manager who was highly committed to SPI was replaced by someone with a lower commitment, all prior SPI effort was lost. Therefore, based on the above discussion, we have developed the following hypothesis.

H1: Management commitment has a positive relationship with the SPI implementation in GSD.

3.1.2 Staff Involvement (SF2)

Sulayman et al [LT2] define staff involvement as the extent to which organizational staff own, believe, attain and participate in the process improvement activities. Bayona et al [LT3] highlighted that the staff involvement during the process definition of SPI activities is important to make them feel part of the program. Ramasubbu [LT4] reported the results of an industrial empirical study and pointed out that staff involvement in SPI activities reduce the resistance to the deployment of new processes. As a result of the given discussion, the following hypothesis is developed.

H2: Staff Involvement has a positive relationship with the SPI implementation in GSD.

3.1.3 Strong Relationship (SF3)

According to Niazi et al [LT5], "strong relationship is the degree to which the team members can effectively coordinate and communicate to implement the SPI program". Strong relationship is the key element to effectively perform the SPI related activities and tasks [LT6]. Moreover, it leads to better team management, decision making, risk management and staff coordination [LT6]. Niazi et al, [LT5] reported that GSD teams might not be able to accomplish SPI activities within time and budget due to the lack of trust and support among the team members. Higher team management should motivate the team members to participate and associate with SPI related activities in order to build long term positive and trustworthy relationship with different other distributed teams [LT5]. Consequently, we argue that a strong relationship is a key factor to successfully implement the SPI program in GSD.

H3: Strong relationship has a positive association with the SPI implementation in GSD.

3.1.4 Information Sharing (SF4)

Sulayman et al [LT2] define information sharing as "the degree to which the distributed team members coordinate and communicate to share the information to involve in process improvement program". Ramasubbu [LT4] reported that proper information sharing among the geographically distributed sites could assist the team members to positively execute the SPI activities. Khan et al [LT7] concluded that team members can properly participate in the process improvement activities based on the information and knowledge sharing, management of information and information partnership [LT7]. Thus, we proposed the following hypothesis.

H4: Information sharing has a positive association with the SPI implementation in GSD.

3.1.5 SPI Expertise (SF5)

Bayona et al [LT3] define SPI expertise as the extent to which individuals can achieve specific SPI goals [LT3]. According to Hall [LT1], the success of SPI implementation programs depends on the expertise of team members. More specifically, if the management staff of SPI program has appropriate process improvement knowledge and awareness, then there is more chance of process improvement success and adoption in the best practice of domain [LT8]. Otherwise, the deployment of the process improvement program may end with the failure and frustration [LT3].

H5: SPI Expertise has a positive relationship with the SPI implementation in GSD.

3.1.6 Roles and Responsibilities (SF6)

Bayona et al [LT3] suggests that the assignment of specific roles and responsibilities to team members assist the SPI implementation process. Roles and responsibilities should be clearly defined; otherwise confusion may occur during the implementation of SPI activities [LT3]. Therefore, we hypothesize that

H6: Roles and Responsibilities have a positive relationship with the SPI implementation in GSD.

3.1.7 SPI Leadership (SF7)

Hall et al [LT1] reported in their empirical study that most of the respondents highlighted the importance of the managers' leadership. They specified that the leadership of SPI team is vital for the successful execution of the SPI program [LT1]. The management should have the ability to direct and encourage team members to achieve the specific goals [LT3]. The success and acceptance of the SPI program mostly depend on the skillful top management individuals. If they have ample knowledge and deep understanding of SPI program, then they could accomplish their concern objectives [LT8]. Lack of SPI leadership could undermine the effectiveness of SPI program and the organization might not be able to actualize the key objectives of the business [LT1]. Hence, we argue that SPI leadership is a core factor for the SPI implementation.

H7: SPI leadership has a positive association with the SPI implementation in GSD.

3.1.8 SPI Awareness (SF8)

Sulayman et al [LT2] explained SPI awareness as the degree to which the top management takes the initiatives of SPI certification and provides team members with the training opportunities. Deployment of SPI program is the practice of implementation of new processes in an organization [LT5]. It is important to motivate the team members to conduct and participate in the awareness sessions relating to the implementation of process improvement program. Therefore, we have developed the following hypothesis.

H8: SPI Awareness has a positive association with the SPI implementation in GSD.

3.1.9 Skilled Human Resources (SF9)

The results reveal that success factor 'SF8: skilled human resources' can play a significant role in SPI implementation program. Various researchers have discussed the significance of skilled humans for SPI activities. Bayona et al, [LT8] emphasized on the deployment of the qualified workers having professional certification and experience in the field of computer

science, management and other related fields. They consider the skilled staff as the backbone of the GSD industry. Consequently, we hypothesize that

H9: Skilled Human Resources have a positive association with the SPI implementation in GSD.

3.1.10 3C's (Communication, coordination and control) (SF10)

Khan et al, [LT9] define 3C's as the process of knowledge transmission between the distributed team members and the mode of transfer they adopt to enhance this interaction. Effective communication channels are claimed to assist process improvement. Coordination refers to the contribution of different people working together on a task for a specific goal [LT9]. Control refers to "the process of adhering to goals, policies, standards or quality levels" [LT9]. The Control manages the basic structures needed for SPI implementation i.e. on time, in budget and desired quality software development. Control and coordination are correlated with each other and both of them depend on communication [LT10]. Therefore, for successful implementation of SPI activities, it's significant to properly manage the 3C's issues.

H10: 3C's (Communication, coordination and control) have a positive association with the SPI implementation in GSD.

3.2 RQ2

According to Niazi [LT11], the critical factors are presenting the key areas where the organizational management must focus to achieve the specific business goals. Niazi [LT11] and S. U. Khan et al. [LT12] shed light that limited attention given to those key areas can undermine the business performance. Critical factors may differ from person to person as it depends on the position of individual's hold in an organization. Critical success factors (CSFs) depend on the geographical regions of the managers and may change with the passage of time [LT11].

In this research study, we have followed the following criteria in order to conclude the criticality of the identified 10 success factors:

If a factor has frequency ≥50% of the selected primary studies, then the factor is considered as a critical factor. The same criteria have been used by other researchers in different other domains [LT11, LT7].

By using the above criteria, the identified CSFs are: SF1: Management commitment (84%), SF2: Staff involvement (73%), SF6: Roles and Responsibilities (58%), SF7: SPI leadership (53%) and SF9: skilled human resources (63%). The identified CSFs are labelled as the most critical for SPI because their frequency ≥50% of all the other success factors.

3.3 RQ3

The hypothetical research framework of the reported success factors is presented in Figure2. The framework is based on the identified ten success factors and their relationship with SPI implementation as discussed in section 3.1. The framework consists of ten independent variables (i.e. the reported success factors in section 3.1) and the dependent variable of the proposed framework is the humans' related SPI implementation in GSD. We have also identified one moderating variable (i.e. organizational size). Existing software engineering and organizational development literature discussed that there are various operational differences between small, medium and large organizations. Small and medium organizations more concentrate on practices, while large organizations are concerned about the formal process [11]. In spite of this recognition, there has been no systematic attempt to verify whether small and large software organizations implement SPI programs differently [12]. So, it is interesting to verify the importance of organizational size on SPI success in this study. Thus we come up with the following hypothesis.

H11: The reported success factors influence the SPI implementation activities for a large organization to a greater extent than that of small and medium organization.

It is shown in Figure 2, that each success factor has a positive relationship with the dependent variable (i.e. Humans related SPI implementation in GSD). The framework is presenting a relational view of the independent, moderating and dependent variables. The relationship of the independent variables is presented based on the proposed hypotheses.

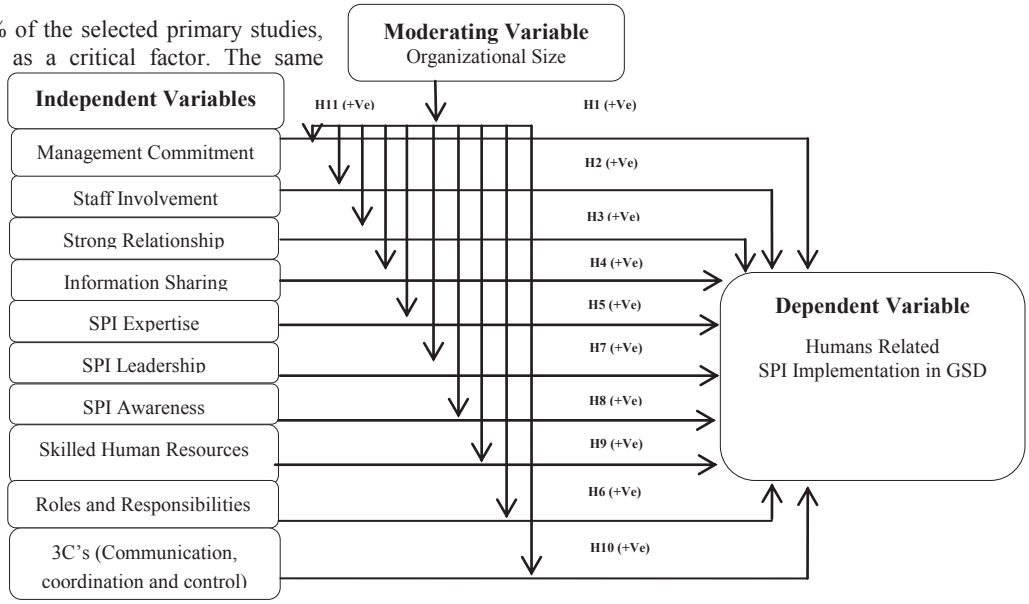

Figure 2: Proposed Hypothetical Framework

4. THREATS TO VALIDITY

During the SLR process, most of the data were extracted by the first author of the article. However, we tried to alleviate this threat by observing any unclear problems and discussed them together, still there exists a higher risk that a single researcher could be biased and continually extract the wrong data. However, the co-authors were involved to randomly check different steps in the SLR.

One possible threat to internal validity is that for any selected SLR article, the reported success factors might not have assuredly described their primary causes. It might possible that in some articles there may have been a trend to report specific types of factors. Most of the selected articles reported findings of empirical studies, experience reports and case studies which might be subject to the publication bias.

In addition, most of the authors of the selected 19 primary studies are from academia, which might lack a deep knowledge about the current trends of SPI programs in distributed contexts. In order to mitigate this threat, we planned to perform an industrial study to assess the validity of the identified success factors.

5. CONCLUSIONS AND FUTURE WORK

Presently majority of the software development firms are adopting the phenomena of global software development. The fast growing nature of GSD motivated us to identify humans related success factors that can positively affect the SPI program. We have followed SLR approach and 19 research articles related to humans oriented SPI and GSD were selected. We have identified a total of 10 success factors from the selected research articles. In the identified 10 success factors, total five factors were categorized as the most critical factors. The identified critical success factors can act as a guide for the SPI practitioners to effectively implement the SPI activities in the domain of GSD. The critical factors are presenting the key areas which have much more impact on process improvement implementation as compared with the other identified success factors. We have developed the hypothetical framework of the identified success factors and the SPI implementation based on their relationship discussed in the literature. We believe that the findings of this research work can possibly result into tackling the problems associated with the humans related process improvement activities, which is a key to the success and progression of GSD organizations.

The following points highlight the future directions of this study.

- Empirically validate the identified factors in the context of humans related to software process improvement.
- Investigate the people related challenges that could negatively impact the SPI process.
- Conduct industrial empirical study with SPI practitioners to identify additional success factors and challenged.
- Empirically assess the hypothetical framework of this study in order to test the hypotheses.

The concluding aim of this study is to develop a model that could address the humans' related aspects of software process improvement in GSD. This model will assist the GSD organizations to assess and measure their process improvement readiness prior to SPI implementation.

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7. Appendix 1

See Table 4

Table 4. Selected primary studies using SLR

ID	Title	QA1	QA2	QA3	QA4	QA5	Final Score
[LT1]	"Hall, T., Rainer, A., Baddoo, N.: Implementing software process improvement: an empirical study. Software Process Improvement and Practice 7(1): 3-15 (2002)"	1	1	0	1	1	4
[LT2]	"Sulayman, M., Mendes, E., Urquhart, C., Riaz, M., Tempero, E.: 'Towards a theoretical framework of SPI success factors for small and medium web companies. Information and Software Technology, vol. 56, pp. 807-820 (2014)"	0.5	1	0.5	1	0.5	3.5
[LT3]	"Bayona-Oré, S., Calvo-Manzano, J. A., Cuevas, G., San-Feliu, T.: Critical success factors taxonomy for software process deployment. Software Quality Journal, vol. 22, pp. 21-48, (2014)"	0.5	1	0.5	1	1	4
[LT4]	"Ramasubbu, N.: Governing Software Process Improvements in Globally Distributed Product Development. IEEE Transactions on Software Engineering, vol. 40, pp. 235-250 (2014)"	0.5	0.5	0.5	1	0.5	2.5
[LT5]	"Niazi, M., Wilson, D., Zowghi, D.: A maturity model for the implementation of software process improvement: an empirical study, Journal of systems and software, vol. 74, pp. 155-172 (2005)"	1	1	0	1	1	4
[LT6]	"Niazi, M., Babar, M. A., Verner, J. M.: Software Process Improvement barriers: A cross-cultural comparison. Information and Software Technology, vol. 52, pp. 1204-1216 (2010)"	1	0.5	0	1	0.5	3
[LT7]	"Khan, A. W., Khan, S. U.: 'Critical success factors for offshore software outsourcing contract management from vendors' perspective: an exploratory study using a systematic literature review, IET software, vol. 7, pp. 327-338, (2013)"	1	0.5	0	0.5	1	3
[LT8]	"Bayona, S., Calvo-Manzano, J. A., San Feliu, T.: 'Review of Critical Success Factors Related to People in Software Process Improvement' in Systems, Software and Services Process Improvement'(Springer Berlin Heidelberg, Germany, 2013) pp. 179-189"	0.5	1	0.5	1	0.5	3.5
[LT9]	"Khan, A. A., Basri, S., Dominic, P.D.D., Fazal, E. A.: A Survey based study on Factors effecting Communication in GSD. Research Journal of Applied Sciences, Engineering and Technology, 7 (7), 1309-1317 (2013)"	1	0.5	0.5	0	1	3
[LT10]	"Espinosa. C., Edrein, I., Rodríguez-Jacobo, L., Fernández-Zepeda. A. J.: A framework for evaluation and control of the factors that influence the software process improvement in small organizations. Journal of software: Evolution and Process, Vol (25) 4, 393-406, (2013)"	1	0.5	0	1	1	3.5
[LT11]	"Niazi, M., Wilson, D., Zowghi, D.: Critical success factors for software process improvement implementation: an empirical study. Software Process: Improvement and Practice, Vol. 11 (2). pp 193-211, (2006)"	1	1	0	1	1	4
[LT12]	"Khan, A.A., Keung, J.: Systematic Review of success factors and barriers for Software Process Improvement in Global Software Development. IET Software, ISSN 1751-8814 (2016)"	1	1	0.5	0	1	3.5
[LT13]	"Khan, U. S., Niazi, M., Ahmad, R.: Critical Success Factors for Offshore Software Development Outsourcing Vendors: An Empirical Study. Product-Focused Software Process Improvement, pp. 146-160 (2010) "	1	1	0	0	1	3
[LT14]	"Ngwenyama O., Nielsen, P. A.: 'Competing values in software process improvement: an assumption analysis of CMM from an organizational culture perspective, IEEE Transactions on Engineering Management, vol. 50, pp. 100-112, (2003)"	0.5	0.5	0	1	0.5	2.5
[LT15]	"Stelzer, D., Mellis. W.: Success factors of organizational change in software process improvement, Software Process: Improvement and Practice Vol. 4 (4), 227-250, (1998)"	1	0.5	0	1	0.5	3
[LT16]	"Iversen, J. H., Mathiassen, L., Nielsen, P. A.: Managing risk in software process improvement: an action research approach. MIS Quarterly, 2004, pp. 395-433 (2004)"	0.5	0.5	0	1	0.5	2.5
[LT17]	"Bunditwongrat, N., Mathupayas, T., Atcharawan, N.: An empirical framework of key success factors for software process improvement. Proceedings of the European Conference on Information Management & Evaluation, pp-82-90 (2011)"	1	1	0.5	1	1	4.5
[LT18]	"Niazi, M., Wilson, D., Zowghi, D.: A model for the implementation of software process improvement: A pilot study. third International Conference on Quality Software, pp. 196-203 (2003)"	0.5	1	0	1	0.5	3
[LT19]	"Rainer, A., Hall, T.: Key success factors for implementing software process improvement: a maturity-based analysis. Journal of systems and software, Vol. 62(2), pp.71-84 (2002)"	1	1	0	1	1	4