

SYSTEMATIC LITERATURE REVIEW AND EMPIRICAL STUDY FOR SUCCESS FACTORS: CLIENT AND VENDOR PERSPECTIVE

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Abstract

Software development organizations are adopting strategies because they produce a major return on investment, on the other hand, there are several success factors related to outsourcing, mostly observed by SPI (Software Process Improvement). SPI can play an important role in the positive implementation of outsourcing projects. The aim of this research is to find out success factors that can positively change SPI in outsourcing organizations with client and vendor perspectives. We have used two approaches for identifying and validating the success factors, they are: Survey questionnaires and SLR (systematic literature review). Through these approaches, we have identified different success factors related to client and vendor perspectives in the SPI outsourcing environment. Our research finding is that the ranking of SLR success factors and the survey success factors have significant difference. The client and vendor outsource organizations through SPI implementation programs can be helped by identified success factors. The t-test is used to measure these success factors. Client and vendor categorization was used to present an extensive image of software process improvement programs and their related success factors. The highest ranked success factors may be used for outsourcing organizations before starting SPI programs. The outcomes of this study may be valuable for problems related to SPI implementations which are necessary for the development and success of outsourcing organizations.

Keywords: Client and vendor, Critical success factors, Software development outsourcing, Software process improvement, Systematic literature review.

1. Introduction

Outsourcing is a process in which organizations involve other party that is outside from their own organizations. Nowadays Outsourcing is a growing trend in business world. Organizations are taking lot of benefits from outsourcing in software integration process still there are lot of problems which are very important to address. Outsourcing plays a positive effect on the software integration process and finds out critical success factors (CSFs) [1]. SPI (Software process improvement) is used for improving, evaluating and developing the software development process of software organizations. Critical factors are the key areas which may have less or more impact on process improvement implementation. There are multiple methods for efficient management of software process development. Professional organizations have achieved software development processes and also purposed process improvement models in software outsource organizations. Like, capability maturity model integration (CMMI) the model consists of systematic practices for assessment and improvement process [2].

The IDEAL model supports the organizations that they began, plan, and implement SPI programs. There are five phases that a company need to run their basic tasks these are known as IDEAL (“Initiating, Diagnosing, Establishing, Acting, and Learning”) model. The IDEAL model frequently provided effective improvement in process improvement activities through reasonable guidelines. During the development phases of this model, the important features of outsourcing management are investigated [3]. The purpose of the research study was to extend Software process improvement implementation management model (SPIIMM) based on the client and vendor perspectives in the environment of outsourcing organizations, as presently most of the investigators focus on the client perspective of the outsourcing organizations and also emphasize on involved activities in each maturity level of SPIIMM [2]. We have identified different factors from previous researches such as cost saving, infrastructure, skilled human resource, quality of products and services of products that are usually considered significant by the outsourcing organizations [4].

Software companies for assessing their readiness for software development use software outsource vendor readiness model (SOVRM) which is comprehensive model of outsourcing [5]. The results of the study show that the differences and similarities between client and vendor by identifying CSFs from different continents. After identifying the factors from SLR we compare our empirical outcomes with SLR and identified some additional factors. The identified CSFs from the different groups of practitioners were analysed because they know what essential factors are used for SPI programmers for successful implementations. Software process improvement implementation success factors provided through an industrial survey in the outsourcing environment. Initially, success factors were identified through a systematic literature review and then validated using industrial survey approaches [6-10]. We have identified factors which are significant for trust creating between client and vendor like face to face communication, face to face meeting, contract management among vendor and client, procedures, define tools and policies and play a significant part for reliable management in trust creating among vendor and client [11, 12].

In this paper, the first steps toward the software process improvement implementation model are discussed through identifying success factors that have a positive impact on SPI practices in the outsourcing environment. Furthermore, we have classified the identified CSFs with respect to client and vendor organizations. The purpose of vendor and client classification is to emphasize the importance of each factor for the client and vendor perspective in outsource organizations. Furthermore, we have identified the different practices through a systematic literature review (SLR). The complexity of the integration process in the outsourcing projects overcome in order to identify CSFs practices will assist by outsourcing vendors [6, 13, 14].

Software process improvement allows organizations to successfully calculate their present software development abilities [9,15,16]. The motivation behind considering factors for both client and vendor organizations is to highlight the importance of each other in outsourcing organizations [10]. Recent researches had only focused on vendor organization in SPI outsourcing. Neglecting client factors in outsourcing process results in less satisfaction, and coordination. It is required to add factors for both client and vendor to maximize the outcomes in the form of SPI project success in outsourcing [17,18]. Critical success factors were identified using systematic literature review (SLR) and empirical study approaches in our research related practices and barriers were adopted from existing research[19].

The author describes the client and vendor association for achieving useful and common goals that are completely based on commitment and trust [2, 20, 21]. The output of this research help the scholars to find out best relationship between trust, KM, GSD and collaboration [22-28].

Typically, the relationship between vendor and client organization may be converted into an outsourcing partnership for long lasting and successful outsourcing. SLR (Systematic Literature Review) such as used to calculate, classify, and examine the existing literature with respect to an existing research area by applying the exclusion and inclusion criteria. SPIIMM (software process improvement implementation management model) develops by SPI in outsourcing that could improve and measure their software process improvement activities and assist outsourcing organizations but the author only focuses on vendor organization and neglect the client perspective, so we have addressed this problem by adding client perspective [12, 29, 30].

In this study, we have discovered different factors through a systematic literature review (SLR) approach these are significant for software outsourcing relationships and trust established between clients and vendors. We have also applied the customized search strings for performing an SLR; search strings were derivative from the research questions [11,31,32]. A large amount of the significant factors is identifying through training and relationship programmers that are usually measured significant for trust establishing in SOR (Software outsourcing relationships) [13, 33, 34].

After introduction initially we will discuss motivation of this study to understand main aim of research than methodology will be discussed in detail with the help of some tables and figures to support our research. At the end, discussion on the result of study and conclusion of paper will be discussed briefly.

2. Research Methodology

2.1. Systematic literature review

Systematic Literature Review approach is followed to calculate, classify, and examine the existing research with respect to an existing research area by applying exclusion and inclusion criteria. The last 12-year time span is used for this research. SLR has two main steps: Planning and Conducting [14,35] as shown in Table 1.

Table 1. Systematic literature review phases.

Planning of review	Conducting of review
Research question	Data extraction
Data source	Data synthesis
Exclusion and inclusion criteria	Primary study selection
Research strings	
For study selection quality of criteria	

2.1.1. Planning of review

Description of the planning phase of the Systematic Literature Review (SLR).

2.1.1.1. Research question

Our research purpose is to find out SFs with respect to vendor and client organizations for the successful implementation of SPI programs in the outsourcing environment. In this research we have addressed the following research questions:

RQ1: What are the CSFs for software process improvement in outsourcing environments found in SLR and ES?

RQ2: Do the CSFs found in the literature and an empirical study relate to client and vendor organization?

RQ3: Does the identified CSFs from the empirical study and those found from SLR differ with each other?

RQ4: What is the number of CSFs identified from empirical study and SLR?

2.1.1.2. Data source

Based on previous research experience suitable repositories were identified and suggestions presented by [15, 36].

Data sources included:

- ACM Digital Library
- IEEE Explore
- Wiley Inter Science
- Springer Link
- Science Direct

In our research mechanism and capabilities, we have used different digital libraries and adopted different search strings.

2.1.1.3. Research string

Search string formulates use derived keywords from existing literature and research questions. Used “AND” and “OR” Operator for concatenating the keywords.

(“ Success factor” OR “Features” OR “motivators” OR “obstacle” OR “Characteristics” OR” Variables”) AND (“software process improvement” OR “SPI” OR “software process enrichment OR “CMMI” OR” SPICE” OR “CMM” OR” “software process evaluation” OR “software process enhancement” OR “software process appraisal” OR “software process assessment”) AND (“distributed software development” OR “global software engineering” OR “global software development” OR “software outsourcing” OR “GSD” OR “IT outsourcing” OR “offshore software development” OR “information technology outsourcing” OR “IS outsourcing”) AND (“client software development organizations” OR “client software development companies” OR “client analysis” OR “client perspective” OR “customer” OR “outsourcer” OR “purchaser” OR “customer” OR “shopper” OR “purchaser” OR “user”) AND (“vendor software development organizations” OR “vendor software development companies” OR “service-provider” OR “vendor perspective” OR “vendor analysis” OR “seller” OR “dealer” OR “trader” OR “marketer”) AND (“client and vendor analysis” OR “client and vendor perspective”).

2.1.1.4. Inclusion criteria

- The full text must be available and written reports in English.
- Responses from conferences, journals, workshops or book articles.
- We collected reports which described SPI implementation activities in outsourcing, mostly those success factors which are related to SPI implementation in outsourcing.

2.1.1.5. Exclusion criteria

- The papers are not related to SPI in the perspective of outsourcing were disqualified.
- The unsatisfactory information or SPI standards concerning software process improvement.
- The duplicates are excluded.

2.1.1.6. Study quality evaluation criteria

Quality evaluation was presented parallels in the data extraction phase from the selected articles. For qualitative and quantitative assessment of the selected articles, we have developed the checklist. Table 2 shows the strategy described in previous research that was followed [37, 38].

2.1.1. Conducting the review

The following steps have been taken to conduct the review.

2.1.1.1. Selecting the articles

After applying the exclusion and inclusion criteria we have selected the relevant papers which are discussed in phase (1, 2, 3, 4 and 5) respectively. Using the tollgate approach, the study selection process is as shown in Table 3.

Phase 1 (Ph 1): using search terms the relevant articles were searched.

Phase 2 (Ph 11): Based on the title and abstract exclusion and inclusion criteria was performed.

Phase 3 (Ph 111): Based on conclusions and introduction exclusion and inclusion criteria performed.

Phase 4 (Ph 1V): based on full-text exclusion and inclusion was performed.

Phase 5 (Ph V): Finally, in the SLR the primary studies selection was included.

Table 2. Quality assessment checklist for the selected articles.

QA	Questions Checklist Questions	Scores
QA-1	Is the study discussing any success factors for the implementation of SPI?	Partial = 0.5, No = 0, Yes = 1
QA-2	Do the research methods address the research questions?	Partial = 0.5, No = 0, Yes = 1
QA-3	Is the study discussed SPI implementation standards and models?	Partial = 0.5, No = 0, Yes = 1
QA-4	Does the outcomes of research relevant to the research objectives?	Partial = 0.5, No = 0, Yes = 1
QA-5	Does the identified data relate to software process improvement?	Partial = 0.5, No = 0, Yes = 1

Table 3. Using the tollgate approach selected the related articles.

E-databases	Ph 1	Ph 11	Ph 111	Ph 1V	Ph V	Selected articles % (n = 75)
Wiley Inter Science	110	40	10	06	5	7%
IEEE Explorer	450	208	82	35	25	36%
Science Direct	366	153	72	20	10	13%
ACM Digital Library	400	115	63	30	25	36%
Springer Link	214	97	42	20	10	13%
Total	1530	613	269	111	75	100%

2.1.1.2. Data extraction

Data is extracted from different articles by identifying problems from SPI related papers also client vendor papers are searched.

2.1.1.3. Data synthesis

From the 75 research articles we have extracted CSFs related to SPI implementation with respect to client and vendor perspective and also research questions are evaluated from these papers.

2.2. SLR results

RQ1 and RQ3 (Success factors of SPI in the outsourcing environment) is organized to address the RQ1 and RQ3, Table 4 represents the list of CSFs that are identified in the SLR approach. Calculating the results of RQ1 and RQ3, we have conducted SLR and empirical studies that have already been used by most of the researchers in our research. The complete data analysis and results of RQ1 and RQ3 are presented. We have performed a related study of identified success factors during the empirical study and SLR [12, 39, 40].

We have identified organizational culture, Strong relationship, Mutual understanding, human skilled and 3C (communication, coordination, and control) related factor for bounding partnership between client and vendor [15, 41, 42]. Also find 3C (communication, coordination, and control) and resource utilization determine clients had no objection for change in the development and adding new resources to the development when the entire programs and plan were shared and made clear keeping in view his requirements [6,43].

SPI success factors related to people involved during the development of projects are organizational culture; information sharing, awareness, and commitment are identified [17, 44]. Some of the factors according to client and vendor partnerships like communication, mutual understanding information sharing, mutual goals [45-50] shown in Table 4.

Table 4. Success factors identified from systematic literature review.

S- No.	Success factor	Occurrences in SLR(n=75)	
		Freq	%
SF1	Trust, Satisfactions	51	68
SF2	3C(communication, coordination and control)	50	67
SF3	Management commitment	49	65
SF4	Bi-direction Information sharing	48	64
SF5	A strong relationship between partners	47	63
SF6	Mutual understanding between partners	46	61
SF7	Organizational culture	45	60
SF8	Continuous organizational support	43	57
SF9	Skilled human resources	42	56
SF10	Allocation of resources	41	55
SF11	Process improvement awareness	40	53
SF12	Process improvement expertise	39	52
SF13	Setting process improvement goals	38	51
SF14	Organizational infrastructure	36	48
SF15	Joint management infrastructure	35	47
SF16	Staff involvement	32	43
SF17	Process improvement leadership	28	37
SF18	Process improvement evaluation	25	33
SF19	SPI consultancy	24	32
SF20	Process improvement standards and Procedures	22	29
SF21	Project pilot implementation	17	23

2.2.1. Vendors and client's classification success factor through SLR

We observe that the client and vendor associations by SLR selected articles assessment. We have performed SLR on total 35 and 40 studies with vendor and

client perspective. Most of the identified factors in outsourcing literature paying less attention to client organizations, rather than vendors [51-55].

Therefore, we have identified success factors for classifying their applicability with respect to vendor and client association (Table 5). The outcome demonstrated that mutual client and vendor association have more resemblance than differentiation in the applicability of the presented success factors shown in Table 5. We have ranked on the basis of frequencies, the variable which have higher frequency gave ranked 1 (i.e., SF1). The purpose of rank is that top factors selected for improvement of SPI model.

Table 5. Analysis identified success factors with respect to client and vendor organizations.

S-No.	Success factor	Client (n=40)			Vendor (n=35)		
		Freq	%	Rank	Freq	%	Rank
SF1	Trust, Satisfactions	28	70	1	23	66	4
SF2	3C(communication, coordination and control)	27	68	2	23	66	4
SF3	Management commitment	21	52	8	27	77	1
SF4	Bi-direction Information sharing	25	62	3	20	57	7
SF5	A strong relationship between partners	23	58	5	24	69	3
SF6	Mutual understanding between partners	24	60	4	22	63	6
SF7	Organizational culture	20	50	9	25	71	2
SF8	Continuous organizational support	23	58	5	20	57	7
SF9	Skilled human resources	20	50	9	22	63	6
SF10	Allocation of resources	23	57	6	18	51	8
SF11	Process improvement awareness	22	55	7	18	51	8
SF12	Process improvement expertise	19	48	10	20	57	7
SF13	Setting process improvement goals	18	45	11	20	57	7
SF14	Organizational infrastructure	16	40	12	20	57	7
SF15	Joint management infrastructure	13	33	13	22	63	5
SF16	Staff involvement	11	27	16	21	60	6
SF17	Process improvement leadership	10	25	17	18	51	8
SF18	Process improvement evaluation	12	30	14	13	37	10
SF19	SPI consultancy	11	28	15	13	38	9
SF20	Process improvement standards and Procedures	10	25	17	12	34	11
SF21	Project pilot implementation	5	12	18	12	34	11

“Management commitment”, ”3C” and “Organization Culture”, “mutual understanding between partners” and “strong relationship between partners” were the most common success factors in equally vendor and client association. Because this approach goes older and therefore the support of organizational management is most important. we have performed the empirical study, which is completed the successful implementation of SPI projects, it is important for higher management to investment, maintain, and contribute to SPI actions [19,56, 57].

During the study we have recognized most of the high-level administrators that are unaware of the significance of SPI and be indecisive to provide a satisfactory amount of assets related to process improvement activities [20, 58, 59].

2.3. Empirical Study

2.3.1. Success factors identified from empirical study

In this section, we have discussed the results of the SPI practitioner survey. To answer RQ2, based on the success factors identified in the SLR we performed an online survey of SPI practitioners. The classified result of the success factors is shown in Table 6. The table is divided into three main groups:

Positive (extremely agree (EA), moderately agree (MA), and slightly agree (SA)), negative (extremely disagree (ED), moderately disagree (MD), and slightly disagree (SD)) and neutral (NU). The positive group shows agreed on respondent percentage with the identified success factors in the SLR and the negative group shows those respondents percentage who do not agree with identified success factors in the SLR.

The neutral group shows those respondents percentage that was not sure about the importance of recognized success factors. The outcome showed that most of the respondents accepted the recognized success factors which have a positive impact on SPI implementation in outsourcing environments. Identified success factors show a positive response which was greater than 70%.

SF5 (Strong relation between partners, 96%) was considered by the survey respondents to be a large number of important success factors to successfully implementation of SPI programs. (SF6, 95%) were the second important success factors in the survey respondents.

Mutual understanding is the most important part of process improvement outsourcing. (SF7, SF1, and SF9, 94%) were the third important success factors in the survey respondents. A large number of respondents has considered process improvement standard and procedure and human skills are important success factors because the software process improvement standards must follow according to skills for developing projects in outsourcing. (SF14, 93%) were also important success factors in the survey respondents.

According to previous research, these success factors are common for SPI implementation in the outsourcing environment. The “Negative” category (SF17, 8%) was considered the least major success factor. Hence, 8% of the survey respondents did not consider these success factors for SPI implementation the outsourcing environment. In the “Neutral” category the SPI consultancy and joint management infrastructure (SF15 and SF19, 17%) were the most important success factors.

Table 6. Identified success factors from the empirical study.

S- No.	Success factor	Empirical Observation (N=98)									
		Positive				Negative			Neutral		
		EA	MA	SA	%	ED	MD	SD	%	NU	%
SF1	Trust, Satisfactions	36	26	31	94	0	0	1	1	4	4
SF2	3C(communication, coordination and control)	42	34	14	91	0	1	3	4	4	4
SF3	Management commitment	48	29	11	89	1	1	3	5	5	5
SF4	Bi-direction Information sharing	39	29	13	82	2	3	2	7	10	11
SF5	A strong relationship between partners	40	32	23	96	0	0	1	1	2	2
SF6	Mutual understanding between partners	49	30	15	95	0	0	1	1	3	3
SF7	Organizational culture	49	26	18	94	0	0	3	3	2	2
SF8	Continuous organizational support	44	25	18	88	1	0	4	5	6	6
SF9	Skilled human resources	46	30	17	94	0	0	2	2	3	3
SF10	Allocation of resources	41	27	23	92	0	0	3	3	4	4
SF11	Process improvement awareness	41	33	17	92	1	0	3	4	3	3
SF12	Process improvement expertise	51	20	18	90	0	0	4	4	5	5
SF13	Setting process improvement goals	37	28	21	87	0	1	3	4	8	8
SF14	Organizational infrastructure	38	31	23	93	0	0	2	2	4	4
SF15	Joint management infrastructure	23	32	23	79	1	0	3	4	16	17
SF16	Staff involvement	38	38	14	91	0	2	2	4	4	4
SF17	Process improvement leadership	40	30	12	83	2	0	6	8	8	8
SF18	Process improvement evaluation	37	32	20	90	0	0	3	3	6	6
SF19	SPI consultancy	31	25	24	81	0	1	1	2	16	17
SF20	Process improvement standards and Procedures	27	26	25	79	0	4	1	5	15	16
SF21	Project pilot implementation	29	36	17	83	2	0	3	5	11	12

2.3.2. Client and vendor classification of success factors identified in the empirical study

We have conducted empirical research through a questionnaire survey in which different question was asked of the respondents and defined the role [vendor or client] in his organization related to SPI outsourcing. Shown in Appendix A. Table 7 shows vendor and Table 8 shows client parties have additional similarities than dissimilarities with respect to recognized success factors. Furthermore, vendor and client organizations were extremely or moderately agreed by the results of SLR.

Table 7. Identified success factors from the empirical study with respect to vendor perspectives.

No.	Success Factor	Occurrence in Survey (N = 98)							
		Vendor (N = 52)							
		Positive				Negative		Neutral	
		EA	MA	SA	%	ED	MD	SD	NU
SF1	Trust and satisfactions	20	11	13	84	0	0	0	4
SF2	3C(communication, coordination and control)	21	12	12	86	0	0	2	5
SF3	Management commitment	18	19	7	85	1	1	3	3
SF4	Bi-Direction Information sharing	14	17	11	81	2	2	0	6
SF5	Strong relationship between partners	20	16	15	98	0	0	0	1
SF6	Mutual understanding between partners	25	15	10	96	0	0	0	2
SF7	Organizational culture	26	13	12	98	0	0	1	0
SF8	Continuous organizational support	22	12	12	88	1	0	2	3
SF9	Skilled human resources	22	17	12	98	0	0	0	1
SF10	Allocation of resources	19	15	14	92	0	0	2	2
SF11	Process improvement awareness	20	18	10	92	0	0	2	2
SF12	Process improvement expertise	26	11	11	92	0	0	1	3
SF13	Setting process improvement goals	18	17	11	88	0	1	1	4
SF14	Organizational infrastructure	20	18	12	96	0	0	1	1
SF15	Joint management infrastructure	17	15	15	90	0	0	0	6
SF16	Staff involvement	16	18	12	88	0	1	1	4
SF17	Process improvement leadership	20	16	5	78	2	0	5	4
SF18	Process improvement evaluation	19	15	15	94	0	0	1	2
SF19	SPI consultancy	17	14	14	87	0	1	0	6
SF20	Process improvement standards and procedures	16	15	15	88	0	4	0	12
SF21	Project pilot implementation	17	19	11	90	2	0	0	3

Management commitment (SF3) has a 96% positive response according to client prospective while vendor SF3 has 85% positive response so we have selected success factor SF3 as a client due to its higher frequency shown Fig. 1. We also applied this method to all other success factors as well. As a result, a large number of success factors are related to a vendor as compared to clients shown in Fig. 1.

Table 8. Identified success factors from the empirical study with respect to client perspectives.

No.	Success Factors	Occurrence in Survey (N = 98)							
		Client (N = 46)							
		Positive		Negative		Neutral			
		EA	MA	SA	%	ED	MD	SD	NU
SF1	Trust and satisfactions	16	15	11	91	0	0	1	3
SF2	3C(communication, coordination and control)	21	18	2	89	0	1	1	3
SF3	Management commitment	30	10	4	96	0	0	0	2
SF4	Bi-Direction Information sharing	25	12	2	85	0	1	2	4
SF5	Strong relationship between partners	20	16	8	96	0	0	1	1
SF6	Mutual understanding between partners	24	15	5	95	0	0	1	1
SF7	Organizational culture	23	13	6	91	0	0	2	2
SF8	Continuous organizational support	22	13	6	89	0	0	2	3
SF9	Skilled human resources	24	13	5	91	0	0	2	2
SF10	Allocation of resources	22	12	9	93	0	0	1	2
SF11	Process improvement awareness	21	15	7	93	1	0	1	1
SF12	Process improvement expertise	25	9	7	89	0	0	3	2
SF13	Setting process improvement goals	19	11	10	87	0	0	2	4
SF14	Organizational infrastructure	17	13	11	89	0	0	1	3
SF15	Joint management infrastructure	6	17	8	67	1	0	3	11
SF16	Staff involvement	22	20	2	96	0	1	1	0
SF17	Process improvement leadership	20	14	7	89	0	0	1	4
SF18	Process improvement evaluation	18	17	5	87	0	0	2	4
SF19	SPI consultancy	14	11	10	76	0	0	1	10
SF20	Process improvement standards and procedures	11	11	10	69	0	0	1	3
SF21	Project pilot implementation	12	17	6	76	0	0	3	8

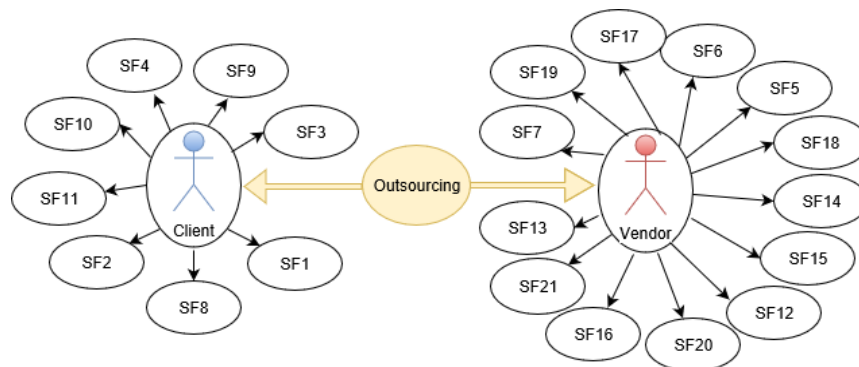


Fig. 1. Conceptual mapping identified success factor related to client and vendor organizations.

3. Results

In this section we have represented the findings gathered from empirical study and systematic literature review. We have made a comparison between results obtained from empirical study and SLR.

3.1. Comparison of empirical study and SLR results

This section describes results that are derived from SLR and Empirical study comparison. This part is describing the converse about the comparison of the empirical study and the SLR results, as shown in Fig. 2.

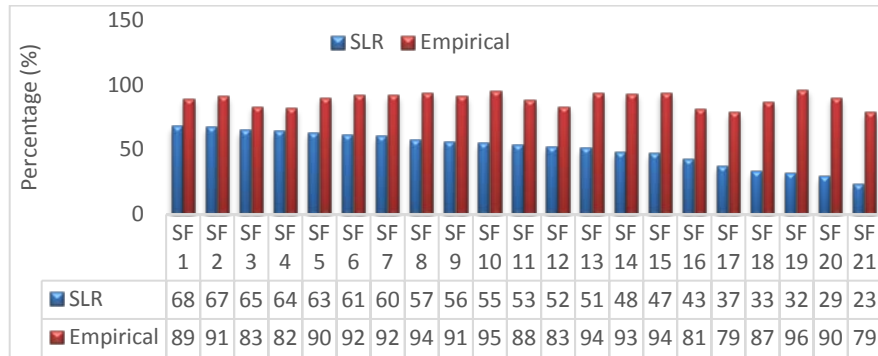


Fig. 2. Comparison of the success factors identified in systematic literature review and empirical study.

Table 9 represents the average ranking of success factors documented using empirical and SLR. Data finds out from empirical studies was categorized as “Positive, Negative and Neutral” as explained above. In the survey questionnaire, the open-ended question was present to the respondents for enabling the identification of additional success factors. There are no other success factors that are effected by the significant level of software process improvement implementations in outsourcing. The positive survey responses are shown in Table 8. The identified success factors ranking significance difference are calculated between the survey studies and SLR, Using Spearman’s correlation we performed correlation statistics analysis. Spearman’s correlation coefficient was begun to be 1.000, representing a positive correlation among the rankings which is to find out from the empirical study and SLR.

This correlation is statistically significant because of the significance value, $p = 0.009$. Outcomes are shown in Table 10 and represented it as the scatter plot graph in Fig. 3.

SLR stand for systematic literature review is used to present a fair evaluation and interpretation of all the available research related to specific research question, research topic or phenomenon of interest, with the help of appropriate methodology [60-65]. While ES stand for empirical study is used to derived knowledge from actual experienced on the basis of direct observation and measured phenomena.

Table 9. Identified Success Factors from the Empirical Study and systematic literature review.

S- No.	Success Factor	Occurrence in SLR(N=75)		Positive Occurrence in Empirical Study (N=95)	
		%	Rank	%	Rank
SF1	Trust, Satisfactions	68	1	94	3
SF2	3C(communication, coordination and control)	67	2	91	6
SF3	Management commitment	65	3	89	8
SF4	Bi-direction Information sharing	64	4	82	12
SF5	A strong relationship between partners	63	5	96	1
SF6	Mutual understanding between partners	61	6	95	2
SF7	Organizational culture	60	7	94	3
SF8	Continuous organizational support	57	8	88	9
SF9	Skilled human resources	56	9	94	3
SF10	Allocation of resources	55	10	92	5
SF11	Process improvement awareness	53	11	92	5
SF12	Process improvement expertise	52	12	90	7
SF13	Setting process improvement goals	51	13	87	10
SF14	Organizational infrastructure	48	14	93	4
SF15	Joint management infrastructure	47	15	79	14
SF16	Staff involvement	43	16	91	6
SF17	Process improvement leadership	37	17	83	11
SF18	Process improvement evaluation	33	18	90	7
SF19	SPI consultancy	32	19	81	13
SF20	Process improvement standards and Procedures	29	20	79	14
SF21	Project pilot implementation	23	21	83	11

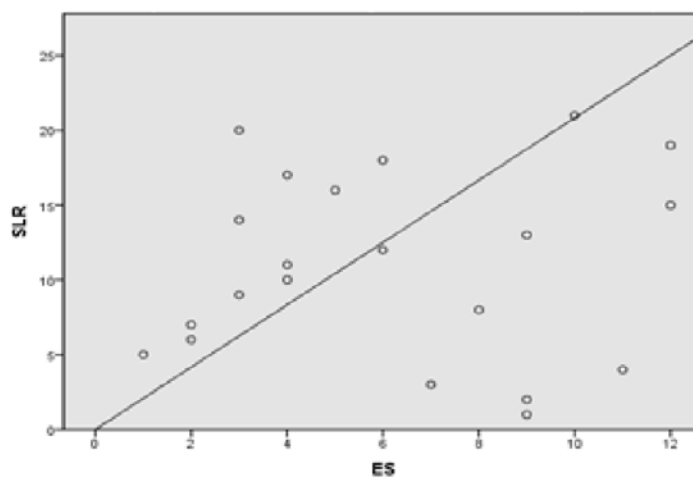


Fig. 3. Scatter plot of the success factors rankings obtain from systematic literature review and empirical study.

Table 10. Rank organized correlation between empirical study and systematic literature review.

			SLR	ES
Spearman's rho	SLR	Correlation Coefficient	1.000	.554**
		Sig. (2-Tailed)	.	.009
		N	21	21
	ES	Correlation Coefficient	.554**	1.000
		Sig. (2-Tailed)	.009	.
		N	21	21

**Correlation is Significant at the 0.01 Level (2-Tailed).

After analysis of Spearman’s correlation, we have found out Independent t-tests to calculate the mean variation among the empirical study and SLR (Tables 11 and 12). We have calculated the significance difference using Levene’s test, between the success factors rankings from the empirical study and SLR in order to access the equality of variance for constructs of more than two groups we use Levene’s test in statics.

Table 12 presents that the t-test results and $t = 2.265$ and $p = 0.005$; 0.032 , representative for important variation among the rankings. For example, SF21 (Project pilot implementation) was ranked 21 in SLR and ranked 11 in the empirical study. Thus, SF21 considered being the highest significance by practitioners in SLR [5, 66, 67].

Table 11. Group statistics for success factors.

	Group	N	Mean	Std. Deviation	Std. Error mean
FACTOR	1.00	21	11.0000	6.20484	1.35401
	2.00	21	7.3333	4.06612	.88730

Table 12. Independent samples test for success factors.

FACTOR	Levene's Test for Equality of Variances		t-test for Equality of Means								
	F	Sig.	t-value	df	Sig.	Mean	Std. Error	95% confidence Interval of the Difference			
								Lower	Upper		
FACTOR	Equal variances assumed		4.954	.032	2.265	40	.029	3.667	1.618	.394	6.938
	Equal variances not assumed				2.265	34.503	.030	3.667	1.618	.378	6.954

3.2. Selected success factors for improving SPIIMM

Researchers were introducing concepts of critical success factors. This concept derivative from managing literature [10, 68, 69]. We have identified 13 CSFs related to client and vendor for improving software process improvement

implementation in the outsourcing environment. These factors are used to improve SPI implementation concerning client and vendor perspectives.

Define CSFs identified related to organizational management areas in which organizational management has to focus on particular production goals. Critical factors might change according to the time these factors can modify and may depend on individual location within an organization [70-75].

We have selected the top thirteen factors in both empirical study and SLR, and then it is considered being a critical factor for improvement of the SPIIMM model concerning client and vendor perspective. Out of 13 critical success factors, six factors are related to client perspective and seven are related to vendors shown in Table 13.

Table 13. List of identified success factors related to client and vendor perspective.

No.	Vendor Perspective	No	Client Perspective
1	CSF3: Management Comments	1	CSF4: Bi-Direction Information sharing
2	CSF9: Human skilled resources	2	CSF10: Allocation of resources
3	CSF12: Process improvement expertise	3	CSF11: Process improvement awareness
4	CSF6: Mutual understanding between partners	4	CSF2: 3C (communication, coordination and control)
5	CSF7: Organizational culture	5	CSF8: Continuous organizational support
6	CSF13: Setting process improvement goals	6	CSF1: Trust and satisfactions
7	CSF5: Strong relationship between partners		

3.3. Related practices for identified CSFs

We have identified different practices related to selected factor for robust framework. The identified practices addressed the reported factors which are the positive and negative impact on SPI implementation in the outsourcing environment among client and vendor perspectives. We have described relevant practices in detail according to SPI implementation in outsourcing [2, 76] shown in Appendix B.

4. Discussion

The purpose of this research was to identify CSFs to successfully execution of process improvement software in outsourcing with respect to client and vendor.

We have identified CSFs related to vendor and client in outsourcing organizations, moreover different software process improvement CSFs are identified related to vendor and client from the empirical study and the SLR.

These success factors are useful to improve SPIIMM with client and vendor perspective. All research questions discussion is shown in Table 14.

Table 14. Summary of SLR questions.

Research Questions	Discussion
RQ1: What are the CSFs for software process improvement in outsourcing environments found in SLR and empirical study??	Management commitment, Staff involvement, Project pilot implementation, Bi-direction Information sharing, expertise of process improvement, Allocation of resources, Awareness of process improvement, Human skilled resources, 3C (control, coordination and communication), Mutual understanding between partners, Support continuous organizational, Leadership for process improvement , Organizational infrastructure, Setting process improvement goals, Organizational culture, Trust and Satisfactions, SPI consultancy, Joint management infrastructure, Process improvement evaluation, Process improvement standards and procedures ,Strong relationship between partners.
RQ2 Does the CSFs found in the literature and in an empirical study relate to client and vendor organization?	Allocation of resources, Process improvement awareness, Skilled human resources, 3C (communication, coordination, and control), Mutual understanding between partners, Continuous organizational support, Leadership for process improvement, a Strong relationship between partners and Setting process improvement goals are the important general success factors recognized by vendor and client organizations, correspondingly. Here is a little major variation among the recognized success factors by vendor and client organizations.
RQ3 Does the identified CSFs from the empirical study and those found from SLR differ with each other?	The rankings achieved from the empirical study and the SLR had a reasonable correlation ($r_s(21) = 0.102$). The Spearman rank correlation was statistically significant $p = 0.659$
RQ4 what are the number of CSFs identified from empirical study and SLR?	The common CSFs from both the empirical study and the SLR were as following: Management commitment, Bi-direction Information sharing, Process improvement expertise, Process improvement awareness, Allocation of resources, 3C (communication, coordination and control), Skilled human resources, Mutual understanding between partners, Continuous organizational support, Organizational culture, Trust and Satisfactions, Setting process improvement goals, Strong relationship between partners. The top 13 factors had selected in both the empirical study and the SLR

5. Conclusion

Outsourcing is real phenomena which are contracted between two parties for development purpose. In SPI outsourcing play a vital role. In this research, we have improved the SPI outsourcing model with the client and vendor perspective. For this purpose, we have identified different factors for SPI with respect to the client and vendor environment based on different existing models such as CMMI, SOVRM, and SPIIMM. In which we have identified different CSFs through systematic literature review, survey and also adapted CBs and related practices from existing literature. Overall, we have found 62% positive factors of SPI implementation with client and vendor perspectives in the outsourcing environment. Specifically, identified 46% relate to client and 54% related to vendor. These results show that SPIMM is an appropriate tool for assessing organization for SPI implementations, also this study is a good guidance for the client and the vendor. Moreover, seven CBs and different practices are adapted from existing literature which is related to categories of CSFs find out during research. In future work, we will improve the existing framework by identifying

more factors related to client and vendor perspective using existing literature and also improved its related practices.

Abbreviations

CBs	Critical Success Barriers
CMMI	Capability Maturity Model Integration
CSFs	Critical Success Factors
IDEAL	Initiating, Diagnosing, Establishing, Acting, Learning
SLR	Systematic Literature Review
SOVRM	Software Outsource Vendor Readiness Model
SPI	Software Process Improvement
SPIIMM	Software Process Improvement Implementation Management Model

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Appendix A
Questioner Survey

Part-I		
Section-1 (Respondent Information)		
Full Name (optional)		Job Title / Position
Have you ever been participated in an outsourcing project?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Not Sure <input type="checkbox"/>	Other <input type="checkbox"/>
Working Experience (Years) in Outsourcing and Software Process Improvement related projects.		
What is the scope of your company?	Client <input type="checkbox"/>	Vendor <input type="checkbox"/>
	Not Sure <input type="checkbox"/>	Other <input type="checkbox"/>
Email Address		
Current address of your organization including country		
How many years of industry/academia experience do you have in your field?		
Have you ever participated in Software Process Improvement Project?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Section- 2(Organization Detail)		
Name of Organization (Optional)		
What is the primary business function of your organization? (You may tick more than one)	Global/offshore Software development <input type="checkbox"/>	Collocated Software Development <input type="checkbox"/>
	Research <input type="checkbox"/>	Other <input type="checkbox"/>
Please specify the size of your organization.	Small <input type="checkbox"/>	Medium <input type="checkbox"/>
	Large <input type="checkbox"/>	Not sure <input type="checkbox"/>

Please specify the number of employees in your organization.	Less than 20 <input type="checkbox"/>	21-100 <input type="checkbox"/>					
	101-200 <input type="checkbox"/>	Above 200 <input type="checkbox"/>					
Please specify the type of your organization	National <input type="checkbox"/>	Multinational <input type="checkbox"/>					
	Not Sure <input type="checkbox"/>	Other <input type="checkbox"/>					
Does your organization adopt Software Process Improvement standards or models? (CMMI/ISO)	CMMI Level-1 (Initial) <input type="checkbox"/>	CMMI Level-2 (Managed) <input type="checkbox"/>					
	CMMI Level-3 (Defined) <input type="checkbox"/>	CMMI Level-4 (Quantitatively Managed) <input type="checkbox"/>					
	CMMI Level-5 (Optimizing) <input type="checkbox"/>	ISO <input type="checkbox"/>					
	Not Sure <input type="checkbox"/>	Other <input type="checkbox"/>					
How long has your process improvement program been in operation? (Years)							
<p>Part -II Software process improvement Success factors</p> <p>The aim of this section is to specify success factors that could positive impact on the implementation of the Software Process improvement program in outsourcing. We have extracted various success factors from the literature using Systematic Literature Review (SLR) approach. Please rank each success factors according to your own understanding and experience.</p>							
Extremely Agree (EA), Moderately Agree (MA), Slightly Agree (SA), Neutral (NU), Slightly Disagree (SD), Moderately Disagree (MD), Extremely Disagree (ED)							
SUCCESS FACTORS	EA	MA	SA	NU	SD	MD	ED
Trust and Satisfactions							
3C(coordination, control and communication)							
Management commitment							
Bi-direction Information sharing							
Strong relationships between partners							
Mutual understanding between partners							
Organizational culture							
Continuous organizational support							
Human skilled resources							

Allocation of resources							
Awareness of process improvement							
Process improvement expertise							
Setting process improvement goals							
Organizational infrastructure							
Joint management infrastructure							
Staff involvement							
Process improvement leadership							
Process improvement evaluation							
SPI consultancy							
Process improvement procedures and standards							
Project pilot implementation							

Appendix B

Related Practices for All Selected CSFs

Success factors	Related practices
CSF1: Trust and satisfactions	<p>P1. We frequently collaborate with clients to set unwavering quality, responsiveness, and different guidelines for us.</p> <p>P2. We often measure and assess consumer loyalty.</p> <p>P3. We as often as possible decide future client desires.</p> <p>P4. We encourage clients' capacity to look for help from us.</p> <p>P5. We occasionally assess the significance of our relationship with our clients.</p>
CSF2: 3C(communication, coordination and control)	<p>P1. Regular travel to conveyed locales makes groups cohesiveness among colleagues.</p> <p>P2. Encourage the utilization of powerful correspondence, coordination and control tools and procedures.</p> <p>P3. Conduct training meetings for remote colleagues with the end goal to determine social, etymological and conduct issues.</p> <p>P4. Create relationships, roles and principles to ease the coordination and power over geographical, cultural distance and temporal.</p> <p>P5. Arrange successive meetings in different structures, for example, video conferencing, personal rotation, and group building works out.</p> <p>P6. Appoint contact or guiding gathering between the dispersed locales.</p> <p>P7. Frequent arranging of communications between dispersed locales: day by day stand-up/call enhances this to a great extent.</p>
CSF3:Management Commitment	<p>P1. Organization management commitments help the SPI program.</p> <p>P2. Organization management save fundamental resources for SPI activities.</p>

	<p>P3. Regularly observe the initiates engaged with SPI program.</p> <p>P4. Provide a well build up infrastructure that could motivate the colleagues to take an interest in process improvement activities.</p> <p>P5. Encourage the exertion of the member include in process improvement activities.</p> <p>P6. Top level management should inception and implementation of SPI programs.</p> <p>P7. Management comment persuade SPI colleagues and non SPI staff individuals to acknowledge the adjustment in process improvement.</p> <p>P8. User see that the change is of advantage to them as people and to the whole association.</p>
CSF4: Bi-Direction Information sharing	<p>P1. We educate exchanging partners ahead of time of evolving needs</p> <p>P2. Our exchanging partners share exclusive data with us.</p> <p>P3. Our exchanging partners keep us completely educated about issues that influence our business.</p> <p>P4. Our exchanging partners share learning of essential business forms with us.</p> <p>P5. We and our exchanging partners trade data that helps foundation of business arranging.</p> <p>P6. We and our exchanging partners keep each other educated about occasions or changes that may influence alternate partners.</p> <p>P7. Information trade between our exchanging partners and us is accurate, timely, reliable, complete and adequate.</p>
CSF5: Strong relationship between partners	<p>P1. We typically team up with customers to set reliable qualities, responsiveness, and distinctive measures for us.</p> <p>P2. We frequently measure and evaluate loyalty of customer's.</p> <p>P3. We consistently choose future customer wants.</p> <p>P4. We urge customers' ability to search for assistance from us.</p> <p>P5. We often evaluate the importance of our relationship with our customers.</p>
CSF6: Mutual understanding between partners	<p>P1. Understanding is another imperative angle to consider for trust-based connections between partners.</p> <p>P2. Mutual comprehension of the SPI and to compose our information to test and support these general thoughts.</p> <p>P3. Mutual comprehension will develop and assume a significant role in understanding the evolving work environment.</p>
CSF7: Organizational culture	<p>P1. An instrument has been built up to make the SPI as a major aspect of the organizations culture.</p> <p>P2. Development group teamed up with two client delegates.</p> <p>P3. We have open-plan space with gatherings of workstations for match programming, meeting rooms and desk areas.</p> <p>P4. We have likewise open-plan office with match programming zone.</p>
CSF8: Continuous organizational support	<p>P1. Responsibilities have been assigned to give specialized help to the procedure activity groups</p> <p>P2. Management at all dimensions of the organizations supports the SPI activity.</p> <p>P3. Management gives solid administration and support to SPI.</p>
CSF9: Skilled human resources	<p>P1. The organization assumes a key job in deciding the survival, viability, and intensity of businesses.</p> <p>P2. The arrangements, practices, and frameworks that impact attitude, behaviour, performance and employees.</p>

CSF10: Allocation of resources	<p>P1. The organization set needs of what they decide to implement dependent on budget and resources plan they don't need to do everything at one time.</p> <p>P2. Schedule the arrangement of resources for activities of process improvement.</p> <p>P3. Management ought to have appropriate plane for the allocation of time and financial resources.</p> <p>P4. Provide all the required technological resources including software and hardware.</p> <p>P5. Provide adequate time to professionals in requests to finish the SPI program.</p> <p>P6. Management ought to set up the schedule of human resources and detail of budget.</p>
CSF11: Process improvement awareness	<p>P1. Planning has been done to sort out and proceed with SPI awareness measures inside the organization.</p> <p>P2. Staff individuals aware about the benefits of SPI usage.</p> <p>P3. Staff individuals aware about their jobs and duties during the execution of SPI inside their unit of work.</p>
CSF12: Process improvement expertise	<p>P1. SPI professionals ought to have detail learning of process improvement models and standards.</p> <p>P2. Conduct training sessions to expand the SPI related skill of professionals.</p> <p>P3. Use the past practices of process improvement outsourcing projects.</p> <p>P4. Draw on the expertise of outside assessors/experts as guides.</p> <p>P5. Use specialists to encourage and direct.</p> <p>P6. The user of the implementation and system team need to comprehend the basics of a quality process.</p> <p>P7. The SPI colleagues ought to have past process improvement experience, necessary skills and information's.</p>
CSF13: Setting process improvement goals	<p>P1. We incorporate our key suppliers in our arranging and objective setting activities.</p> <p>P2. Work has been done to continuously improve a method with the point of utilizing it in entire organization.</p> <p>P3. Work has been done to encourage staff individuals during SPI execution.</p> <p>P4. Work has been done to constantly screen existing SPI execution technique/process with rising and new patterns.</p> <p>P5. Responsibilities have been assigned to conduct continuous SPI execution audits inside organizations.</p>