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# Barriers to Software Outsourcing Partnership Formation: An Exploratory Analysis

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**ABSTRACT** Software Outsourcing Partnership (SOP) is a type of cooperative client-vendor relationship. SOP is an emerging strategy and is different from ordinary software development outsourcing (SDO). Usually, a fruitful outsourcing association might be converted to an outsourcing partnership. Conversely, SOP is not a risk-free business, numerous barriers associated with SOP. The overarching target of this exploratory paper is to find and analyze a list of barriers that are considered obstacles for vendors in the conversion of their surviving contractual outsourcing relationship to a partnership. Firstly, twenty-six barriers to SOP formation were identified through systematic literature review (SLR) from a sample of 106 papers and then an empirical survey was conducted with fifty experts to analyze the significance and applicability of these barriers in the SOP context. The identified barriers were further analyzed based on five variables such as decades, company size, continents, location of analysis, and perspective of the study. Ten barriers were considered as critical barriers (CBs) via SLR. Industrial experts indicate they extremely agree with five CBs. Eight CBs were equally reported on all continents. We found ten CBs common in all types of organizations. Further, twelve CBs were shared in both decades while ten CBs were found common in both academia and industry. Furthermore, four CBs were specific to clients; five were specific to vendors while ten were common to both. The association of various barriers with SOP formation is found statistically significant for twenty-five barriers with effect size ($0.41 < Ø < 0.90$, $p < 0.05$). Stakeholders in SOP should address all the listed barriers especially the critical ones to attain a partner position.

**INDEX TERMS** Systematic literature review, empirical survey, software outsourcing partnership, client-vendor relationship.

## I. INTRODUCTION

Software development outsourcing (SDO) is a corporate business strategy adopted from the last two decades and is growing towards its maturity. It may be simply defined as a ''bond to engineer better and cheaper software across national borders''. The bond normally involves clients from advanced countries and vendors from developing countries to engineer better and cheaper software at the vendor site to be delivered to the clients [1].

There are numerous tasks in software development, such as software architecture and design, programming, and software testing, whichever can be outsourced. Software development outsourcing offers many benefits to client organizations [2]. Small to medium sized organizations with limited technical expertise and resources are best served by outside services. Large organizations may also use an outsourcing approach in order to work with new information communication technologies (ICT) without making any investment [1]. Large organizations may also use SDO due to the unavailability of in-house software development capability and to reduce processing costs [3]. However, the scope of SDO

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is expanding. Today's organizations not only outsource to reduce costs but to improve the company's overall operational performance [4].

Meanwhile, different kinds of companies having different requirements, consequently and considerably many varieties of associations are obligatory [5]. SDO nowadays uses a diversity of methods to outsource software development effort; they subcontract, develop in-house, broaden in-house competence via acquirements, form joint ventures, and shape partnerships with overseas organizations [5]. Due to big economic changes, globalization, antagonism from low remuneration unindustrialized countries, and improvements in ICT, from 1980 onwards numerous business networks have been formed such as multi-vendor contracts, strategic networks, different alliances, coalitions, associations, joint-ventures, and partnerships [6]. Organizational relationships in these networks go beyond the traditional order and supply sequence trades [7]. In this type of relationship, everything like profits, losses, investments, risks, and work burden are distributed amongst partners organizations [8].

Collaborative relationships are typically divided into associations, alliances, coalitions, and joint ventures [9]. A relationship with high trust and low contractual control in enforcing the contract is called an alliance [9]. Outsourcing partnership is a category of an alliance [10]. It is that category of an alliance, which is a combination of both outsourcing and partnering. Therefore, a thorough understanding of both terms is required to understand the combined term outsourcing partnership. Kinnula *et al.* [8] expressed outsourcing as ''the process of transferring the responsibility for a specific business function from an employee group to a non-employee group.'' Outsourcing partnership is an indispensable measure of today's business success because it's crossing the conventional old-style organizational boundaries [11]. A partnership is a long-lasting bi-directional association where confidential data regarding future plans and schemes are shared with each other willingly [12].

In the article at hand software outsourcing partnership (SOP) is defined in this way ''a long-lasting bi-directional risk and reward sharing mutually beneficial relationship between client and their overseas vendor based on mutual trust resulting from a process of shifting the responsibility of developing a software for a particular business function from an employee group to a non-employee group including transfer of assets such as personnel''. In this type of relationship stakeholder openly share risk, opportunities, reward, and workload [13]. Organization develops mutually beneficial policies and plans [8]. It lets the client and vendors focus on their resources in the right track [12].

### A. RESEARCH OBJECTIVE

This exploratory study aims to fill the gap between the researcher and practitioner in the context of outsourcing contract renovation or SOP formation. The objective of this empirical paper is to find and analyze a list of barriers that are obstacles for vendors in the renovation or up gradation of their ongoing contractual outsourcing relationship into a partnership. To achieve our objective, we have executed an empirical survey based on the initial findings of SLR. We have analyzed the barriers found through SLR and empirical surveys. The SLR results were analyzed based on five variables such as decades, company size, continents, location of analysis, and perspective of the study. Further, the associations between various barriers and SOP formation are identified via hypothesis testing.

*The following research questions were addressed:*

RQ1. What are the critical barriers, as identified in the literature that restricts outsourcing clients from the renovation or up gradation of their existing contractual outsourcing association into an outsourcing partnership with vendor organizations?

RQ2. Do the identified barriers show any significant variation over time?

RQ3. How are these barriers related to different company sizes of the organization?

RQ4. Do the barriers show any significant variation from one continent to another continent?

RQ5. What significant variation was observed in the analysis based on the location of analysis (Academia vs. Industry)?

RQ6. What significant variation was observed in the analysis based on the Client-Vendor perspective?

RQ7. What are the critical barriers, as identified in the real-world practice that restricts outsourcing clients from the renovation or up gradation of their existing contractual outsourcing association into an outsourcing partnership with vendor organizations?

RQ8. How various barriers are related to partnership formation?

We have published the SLR protocol with initial results related to RQ1 in a conference paper [14]. This is an extended version of the conference paper in which we have revised the SLR results by adding various analyses. Further, some novel results based on empirical survey are also presented in this paper. Specifically, in this manuscript, we have extended our work by adding the following details:

- In response to RQ1 — based on the SLR complete results with comprehensive explanation are presented in section 4.A.
- In response to RQ2— based on the SLR results timeline analysis is performed. We present the results of timeline analysis based on the SLR in section 4.B.
- In response to RQ3 to RQ6 — based on the SLR results various analyses are performed. We present the results and analysis based on the SLR from section 4.C to 4.F.
- In response to RQ7 and RQ8 — based on the SLR results a questionnaire survey was executed. We present the results and analysis based on the empirical survey in section 4.G and 4.H.

The overarching target of our research is to develop a barriers assessment model for SDO vendor organizations. This model will assist SDO vendor organizations in measuring and improving their outsourcing readiness before starting

outsourcing partnership formation or contract renewal activities. This paper contributes to only one component of the proposed model i.e. the identification and analysis of the barriers.

### B. PAPER OUTLINE

This paper is organized as follows: Section II presents background and motivation. Section III describes the research methodologies. Section IV presents the results. Section V summarize and discussed the results. Section IV discussed the limitations of the study while Section VII concludes the paper by mentioning future work.

## II. BACKGROUND AND MOTIVATION

With the passage of the past two decades, to stay in the market competition, outsourcing partnerships have arisen as one of the important mechanism for growing organizations [12], [15]. Partnerships can benefit organizations to carry on competing by increasing competences [15], developing innovative products [12], connecting to new markets [16], and gaining access to new resource pools [17]. At present, numerous new companies get involved in the global outsourcing of products and services [12]. For instance to increases benefits and to overcome problems, organization like Universal Postal Service and Motorola [18], Kodak, digital equipment corporation, and IBM [19], Shenzhen development bank and Hi Sun [20], United States Achievement Academy and IBM [19], [21], electronic data systems and Xerox [21], Price-water-house-coopers and KPMG [22], EC_Gate and Cap_Gemini [22], Cisco, Corio, Sun, and DELL [22], and Microsoft Net store and US inter-networking [22], establishes partnerships. In view of Ross *et al.* [23], previous research does not report the reasons and factors of partnership formation.

Client organizations typically create SOP with counterpart vendor organization for access to new technology, markets, and complementary skills, or to reduce uncertainty and improve profit and product quality [24]. Cost saving is a good-looking aspect (outsourcing might save half of the development cost or even more), but what if the budget will be misused (you get software with very low quality) [25]. Regardless of numerous benefits, the development of SOP is still in its infancy due to several interactive barriers.

Engaging in partnership with other firms may decrease firms' developmental costs. A study carries out by Piltan and Sowlati [26] found that above 80% of CEOs believed that outsourcing partnerships were the core source of generating nearly 26% of their company revenues. Contrariwise, SOP is not a risk-free trade; significant numbers of failure cases have also been reported [27]–[29]. According to the literature [5], [26], [30], outsourcing partnership has a high disappointment rate. According to King [28] JP Morgan not renew its $5 billion outsourcing contract with IBM. The main cause of failure is the extra complexity introduced in software development projects due to outsourcing [31]. Erickson and Ranganathan [29] have described the case of one SDO project which completely failed due to the problems with meeting expectations of the client on schedule, budget, and quality. Bamford *et al.* [7] and Piltan and Sowlati [26] reports the failure ratio of outsourcing partnerships from 30% to 70%. Several risks for partnership formation have been reported in the academic literature, with most concentration on the vendor opportunism, service disagreement, extreme dependency on vendor, financial loss, and erosion of capabilities like core skills, personnel, and innovative capabilities [32].

Several studies have identified risk in outsourcing partnership such as Tuten and Urban [33], Susarla [34], Verner *et al.* [32], Chou and Pramudawardhani [35], Aundhe and Mathew [36], Kinnula *et al.* [8], Ren *et al.* [37], [38], and Abdullah and Verner [31]. Summary of the few of these are presented as follow:

Tuten and Urban [33], found the risk factors like poor communication, lack of upfront planning, lack of relationship management, diverse goals, unsatisfactory performance signs indication, and lack of trust. Various other reported causes by other scholars are changing of a partner in the middle of the relationship and other corporate causes related to the individual organization or shared.

Abdullah and Verner [31], have suggested a theoretical risk framework for the outsourcing of information technology (IT) system development based on literature from the client's perspective. They mentioned risk factors like customization and integration, inadequate requirements, technical complexity, ill-defined project, contract in favor of vendor and vendor overstated claims, conflict between client and vendor, loss of client's competencies, vendor lack of expertise and experience with the outsourcing tasks, lack of cooperation and commitment, communication problems, client's imperfect commitment, scope, objectives, and requirement creeping, poor audit and control, quality mishaps, naive estimation required resources and schedule, poor governance of project, project management defections, no change management policy, lack of project planning and leadership, and management issues.

Verner *et al*. [32], have recognized risk like poor infrastructure, vendor country instability, communication gap between client and vendor, cultural and language barriers, vendor's opportunistic behavior, vendor incompatibility with a client, lack of protection for intellectual property, and vendor's inflexibility.

Chou and Pramudawardhani [35], consider unstable government, poor decision-making process, nationalization or expropriation of assets, strong political opposition, lack of support from government, improper contract, immature juristic system, public opposition to project, market demand change, geotechnical conditions, delay in project approvals, poor quality workmanship, coordination risk, inadequate distribution of authority and responsibilities, staff crises, differences in working method, competition, and lack of commitment as risk factors in outsourcing.

Aundhe and Mathew [36], identify the risks like bad government policy, loss due to exchange rate; changes in client's corporate structure, client's lack of experience in offshore outsourcing, schedule and budget management, knowledge transfer, client culture, requirements capture, client expectations management, and asset specificity.

### A. STUDY MOTIVATION

Several studies on outsourcing risks are conducted but most of them focus on the IS or IT perspective [31]–[37], [39]–[41], only few of them have study risk from the SDO perspective [32]. Moreover, numerous research works on outsourcing partnership are restricted to onshore model rather than offshore outsourcing [32]. Merely, a narrow quantity of literature has explored outsourcing partnership taking experts is a study unit in most of the studies, researchers keep study unit at organization level only [42]. Furthermore, numerous part of the preceding literature, study outsourcing from client's perspective only [43]. Plentiful amount of studies are conducted on the issue related to partner selection [32]. Partnership assists an organization to depurate their performance in plenteous means [44].

Kinnula *et al.* [8], argue that previous research does not report how partnership is formed. According to Ren *et al.* [37], [38] preceding literature on outsourcing partnership have used social theories of commitment and trust to explain the relationship phenomenon. However, only few studies have examined the determinants of partnerships. Further, preceding researchers fail to recognize the importance of pre-implementation stage factors, which may determine partnership quality.

Additionally, in the existing studies, no SLR process has been used to systematically identify barriers from the literature before these barriers can be used in the survey. Besides, no SLR is conducted to find out barriers from vendor's perspective in the formation of SOP or renovation of enduring contract. Our results have complimented the study conducted up to date in the partnership and outsourcing domain. Further, no sufficiently broad SDO partnership framework for the establishment and ongoing management and execution of an outsourcing partnership can be found in the relevant literature. This exploration based empirical study take the issue from a vendor's angle and targets to fill a particular gap by identifying and analyzing the barriers from a vendor perspective.

## III. RESEARCH METHODOLOGY

We have chosen SLR and survey-based research methods for the identification of barriers to SOP formation. To address the stated research questions, we have executed SLR and empirical survey. Firstly, the existing literature has been reviewed through SLR and as a result; we had identified critical barriers to SOP formation. Secondly, to complement our SLR findings, based on the initial findings of the SLR a questionnaire were administered in the outsourcing industry. We used the empirical questionnaire to know the perception of practitioners about barriers that restrict organizations in promoting or renewing their existing client-vendor relationship to a partnership. We discuss the research methodologies in detail in the following sections.

### A. DATA COLLECTION THROUGH SYSTEMATIC LITERATURE REVIEW

SLR process was used as a primary method for data gathering [45]. It is an unbiased method of data collection based on pre-defined research queries. It helps to collect facts from the included primary studies in a systematic way [2], [46]. An SLR is a novel methodology, adapted from medical in the software engineering domain. It is used since 2005 for the identification, interpretation and, assessment of all related research to a particular area under exploration [45]. SLR has three major phases referred to Kitchenham *et al.* [45]: planning, execution, and reporting. In the article at hand, we first write the SLR plan in the form of a protocol, which is the starting point of any SLR, based studies.

Before the conduction of SLR, we have designed a review plan, specifically known as a protocol. It decreases researcher prejudice and enhances the accuracy and repeatability of the review [47]. Particularly, it outlines context for the exploration, search strategy, research questions used to look for the pertinent literature, setting criterion for including and excluding literature, conduction and publicizing of quality assessment, the plan for extracting data, the plan for synthesizing data, and the process for collecting and synthesizing information for addressing the research questions [2], [48].

#### 1) SEARCH STRATEGY

Search strategy includes the following:

*Search Technique:* Search technique used here is automatic search.

*Electronic Data Sources Used:* The following search venue will be explored

- IEEExplore-[ieeexplore.ieee.org]
- ScienceDirect-[sciencedirect.com]
- ACM-[acm.org]
- GoogleScholar-[scholar.google.com]
- SpringerLink-[springerlink.com]
- CiteSeer-[citeseer.ist.psu.edu]

*Search Strings and Search Phases:* Two types of search string will be used as given below:

Phase1: Trial search string*("Outsourcing partnership") AND ("Software Outsourcing" OR "IT outsourcing" OR "IS outsourcing") AND (Risks OR barriers OR challenges OR demotivates*

We used the research questions and a stepwise strategy to obtain the final search string; the strategy is as follows:

(1) Identify intervention, population, and outcome based on research questions.
(2) Identify the main term and construct search term.
(3) Find the synonyms and alternative spellings for each main term.
(4) Validate the terms and synonyms in any related paper.

(5) Combine these terms using Boolean OR/AND operators.

Phase 2: Final search string

*KEYWORDS_ABSTRACT_TITLE*

*((Partnership OR "Joint-venture" OR "Outsourcing partnership" OR collaboration OR GSD OR "Global Software Development" OR alliance) AND ("Software outsourcing" OR "information systems outsourcing" OR "information technology outsourcing" OR "IS-outsourcing" OR "IT-outsourcing" OR "distributed software development") AND (barriers OR risks OR challenges OR "Negative impacts" OR hurdles OR obstacles OR upgrade OR promotes OR convert OR leads OR transfer OR establish OR Enter OR builds) AND (vendors OR clients OR "Service-provider" OR "service receiver" OR developer OR customer OR outsourcer OR buyer OR consumer))*

*Search validation:* We found few papers from Google Scholar (www.scholar.google.com) using test search string. Before the actual review, these related documents will be cast off for the authentication of the search strings.

*Search documentation:* All search pages were saved as HTML files. The primary data of each search phase was recorded electronically using Google drive form, and the below-mentioned data was documented:

- The title, names of authors, publication venue, date, name of a database, location of analysis, and methodology used in the selected studies.
- Barriers/risk factors reported in the selected study.

#### 2) PUBLICATION SELECTION

Publication selections are done based on inclusion, exclusion, and quality assessment criteria.

The inclusion criteria are listed below:

- The article/paper is written in English only.
- The article/paper is available in full text.
- Research papers that are relevant to our research questions.
- Research work that describes barriers, risk, challenges in IS/IT/software outsourcing.
- Research work that describes barriers, risk, challenges in IS/IT/software outsourcing partnership.

The exclusion criteria are listed below:

- The articles/papers of size less than five pages.
- The articles/papers that are duplicated across different libraries.
- The articles/papers that do not obey any of the inclusion/exclusion criteria.

*Publication quality assessment:* The main drive of quality evaluation is to check and assess the quality of finally selected papers:

- QC1: *Is the objective of the research is clearly defined?*
- QC2: *Is the research methodology appropriate to address the defined objectives of the research?*
- QC3: *Is the outcome of the research is connected to the objective of the research?*
- QC4: *Is it clear how the barriers were identified?*
- QC5: *Do the articles have stated the barrier to outsourcing in the development of SOP?*
- QC6: *Do the articles explain how results were validated or reports limitations?*

Every checklist will be coded as, Yes, or No or Partial. We will calculate a score for each paper; any paper which did not get 50% score will be drooped. Article/papers/books etc. that do not fulfill inclusion criteria and did not pass quality check mentioned above will simply be excluded. The quality checklist items were obtained from dyba and Dingsøyr [49].

#### 3) DATA TO EXTRACTION PROCESS

Data were extracted by primary reviewers using data extraction form given in Table 1. Extracted results were discussed with secondary reviewers. They also review papers in teamwork and compare results with the primary reviewer in order to double check and validate data extracted by the primary reviewer. The data extraction process is pictorialized in Figure 1. The review took from September 2016 to March 2018.

**TABLE 1. Data to be extracted.**

| # | Note | Description |
|---|---|---|
| N1 | Author(s) | Author(s) of the included studies in the SLR. |
| N2 | Title | Title of the paper included studies in the SLR. |
| N3 | Year | Year in which the study was published? |
| N4 | Venue | Publication category: For example, conference, journal, etc. |
| N5 | Research Methodology | A kind of research methodology incorporated in the included article? It can be a case study, experience report, etc. |
| N6 | Data gathering Method(s) | A kind of research tool used for gathering data. For example, interview and questionnaire survey, literature review etc. |
| N7 | Study perspective | The study perspective is grouped into academic (e.g. student cases) and industry. |
| N8 | Company size | It is the size of organization, where the studied project is selected from or the researcher carried out the study. |
| N9 | SOP barrier(s) | The barriers reported in the study. |

### B. DATA COLLECTION VIA A QUESTIONNAIRE SURVEY

To validate the SLR findings and to test the association between the identified factors and SOP formation, we have steered an empirical investigation through an online survey using the online survey tool i.e., Google Drive, in the software outsourcing industry. We intended to confirm the outcomes of our SLR study. Survey inquiry is deliberated as a suitable method for gathering tacit qualitative and quantitative data [50]. In the below sub-sections, we describe the process of designing, data gathering, and analysis.

#### 1) DESIGNING AN ONLINE QUESTIONNAIRE SURVEY

Based on the findings of SLR, we design a questionnaire. The design of a questionnaire survey normally comprises of two phases, sampling, and design. Discovering, listing, selecting,

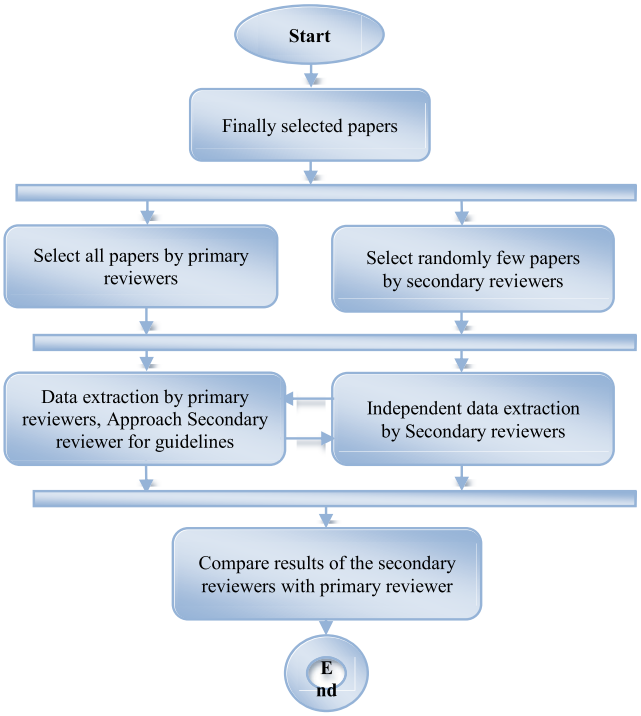


**FIGURE 1.** Data extraction process.

and approaching the suitable field's experts to contribute to the questionnaire based survey is known is sampling [51]. The design phase consists of a set of questions for the sample (contributors) to be answered by them. Both are described briefly in the below subsections.

*Sampling:* We have two choices for sampling A) methodical approach and B) non- methodical approach [51]. Using the first approach, samples are obtained directly from the available population with the help of certain statistics. While approach B) is used, when the entire population is difficult to list [51]. We have used approach B) because in our survey it was impossible to list all software houses involved in outsourcing. Other scholars like Khan *et al.* [1], Wagner *et al.* [52], Cox *et al.* [53], and Niazi *et al.* [54] used a similar approach.

Input to the questionnaire: The barriers identified through SLR, were taken as inputs to the questionnaire.

*Parts:* It is divided into three dissimilar sections i.e. demography, list of 26 barriers to be evaluated by seven points Likert scale, and submission instruction.

*Question Type:* We have incorporated a mixture of open and closed questions.

*Evaluation Scale:* Seven points Likert scale i.e 7-EDA (Extremely Disagree), 6- MDA (Moderately Disagree), 5-SDA (Slightly Disagree), 4-NS (Not Sure), 3-SA (Slightly Agree), 2-MA (Moderately Agree (MA), and 1-EA (Extremely Agree). Besides this, open ended questions like mention barriers which are not listed were also provided.

*Testing:* The questionnaire design was tested through six members of our laboratory.

#### 2) DATA GATHERING

The purpose of the survey is twofold 1) To validate the SLR outcomes and 2) to gain the opinion of the experienced professionals working in the industry in the background of SOP using their expertise.

Our study should be considered mainly qualitative. The purpose of qualitative research is to obtain a general idea of a multifaceted area by exploring it [50]. Questionnaire assessment is mainly considered qualitative because it is a suitable method for gathering and assessing qualitative data. It gives the opportunities for exploration and conversation of new themes that are arises during data collection. Questionnaires surveys give substantial autonomy to the investigator in the pre-arrangement of inquiries. The question of the questionnaire is of two types. Open-ended also called subjective and close-ended called objective. The subjective question allows a variety of answers from the responded side while for objective only the choice can be chosen from the available choices. This method of data gathering assists in reducing the threat of bias relating to the investigator's prejudices. It encourages the contributor to give her/his view regarding a specific question [50], [51].

*Questionnaire Procedures:* Prior to a questionnaire, each participant was sent a questionnaire invitation letter. This letter outlined the main themes to be covered during the questionnaire survey, the expected duration, and measures that could be taken to ensure privacy and confidentiality.

*Executing Surveys:* We invited 101 professionals /experts through email for participation in the online survey.

#### 3) DATA ANALYSIS STRATEGY

The final collection of 50 completed questionnaires was then analyzed further to test various hypotheses.

## IV. RESULTS

### A. REPORTING THE REVIEW

#### 1) TOTAL RESULTS FOUND

By using major search string as derived in section 3.A on the pre-mentioned publisher sites as listed in the same section, we found 3,409 papers. The results of the primary and final selection are given in Table 2. Only 110 papers out of 3,409 qualify the inclusion/exclusion criteria. Finally, the duplication was removed by excluding 04 papers from the final list of papers, which repeated across different digital libraries, and we get a final total of 106 papers as shown in Table 2.

To decrease the primary reviewer's bias, the inter-rater reliability was checked by taking twenty randomly selected papers from the primarily selected papers.

The two secondary reviewers apply inclusion/exclusion and quality criteria to make the final selection. Likewise, the two secondary reviewers also selected twenty articles retrieved through different sources and an initial selection was made based on the title, keyword, and abstract.

We used nonparametric Kendall's coefficient of concordance (W) to evaluate the inter-rater agreement between

**TABLE 2.** Study sources and results found.

| Source | IEEE | SD | ACM | GS | SPL | CS |
|---|---|---|---|---|---|---|
| Total results retrieved | 592 | 759 | 401 | 1343 | 177 | 137 |
| Exclusion based on title and abstract | 432 | 521 | 258 | 1090 | 53 | 117 |
| Primary selection | 80 | 114 | 66 | 119 | 56 | 09 |
| Exclusion based On full text | 73 | 86 | 60 | 109 | 54 | 06 |
| Final selection | 07 | 38 | 17 | 25 | 14 | 05 |
| Total exclusion | 585 | 721 | 384 | 1318 | 163 | 132 |
| **Overall selection:** | **106** | | | | | |
| **Overall exclusion:** | **3303** | | | | | |

primary and secondary reviewers. Kendall's W ranges from Zero (complete disagreement) to one (complete agreement) [55]. The agreement in the initial selection phase was W=0.85 with P=0.006 while agreement in the final selection phase was W=0.79 with P=0.008, which shows a strong agreement between the two groups of reviewers.

### 2) DISTRIBUTION OF STUDIES OVER COLLABORATION MODELS

Using the taxonomy proposed by Khan for outsourcing [2], we classify the papers according to collaboration models as shown in Figure 2. Three types of collaboration models were identified:

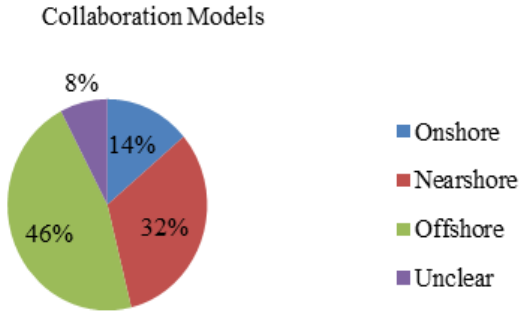


**FIGURE 2.** Distribution of studies over collaboration model.

- Onshore partnership: A partner located in the same country
- Nearshore partnership: A partner from a different country but in the same continent
- Offshore partnership: A partner from an overseas country commonly located on a different continent

In our SLR most of the partnerships formed are offshore (46%) and Nearshore (32%). A partnership formed in Europe is usually Nearshore. According to Butterworth [56], Finland, Spain, Norway, Sweden, and the UK outsource less to offshore countries. Most of the offshore partnership is formed between US-India and US-China [22], [31], [57], [58].

### 3) DISTRIBUTION OF THE PUBLICATION SOURCES INTO YEARS

Figure 3 shows the publication source (i.e. conferences, journals, thesis, or book) involved in our SLR study and their distribution over the years. Figure 3, illustrates that the finally selected articles were published from 2003 to 2018 (1st two months). The 1st paper in our sample was published in 2001. The highest number of articles was found in the year 2013 and 2014 (25%). It is clear from Figure 3 that Journal is the most widely held publishing venue with a count equal to 91 (85% papers). The rest of the articles have been available in other venues, such as conference (12 studies, 18%), thesis, workshops, and book (01 case, 0.02 %). These studies were mostly found in four main fields, specifically SE, IT, IS and organizational science.

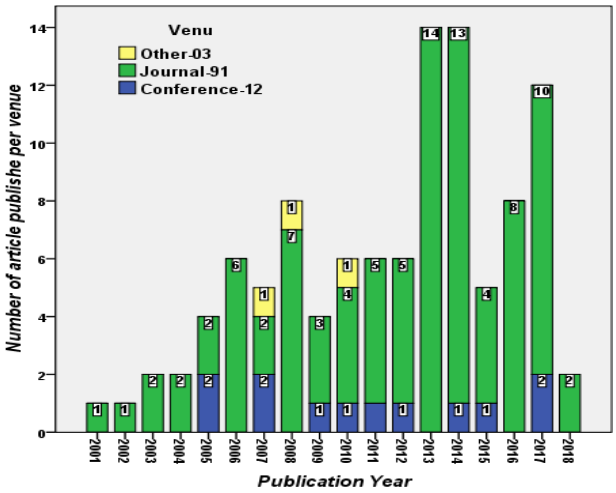


**FIGURE 3.** Year wise distribution of the studies in venue.

We distinguished only publication channels that contribute more than two studies. Nine Journals and one conference have a count greater than two. 'IEEE Transactions on Engineering Management' and IET Software each contribute 05% (05 papers).

'Academy of Management Review', 'Strategic Management Journal', 'Journal of Strategic Information Systems' 4% (04 papers), and 'Information & Management' and 'The Information and Software Technology', 'Journal of International Management', 'Information Systems Frontiers', and 'European Management Journal' all have 3% (03 papers) contribution.

'Hawaii International Conference on System Sciences' is the top conference publication channel in our SLR study with four articles i.e. 04% overall contribution while 'Asia-Pacific Software Engineering Conference' and 'International Conference on Global Software Engineering' are the second most contributing conference venues with two articles i.e. each contributing 02% to the analysis sample. The results might be beneficial for the new researcher working in the domain, interested in knowing about the relevant journal and conference for their publication.

### 4) STUDY STRATEGIES USED IN TWO DECADES

A summary of the selected primary studies, their publication decades, and research methods are presented in Figure 4. Out of the 106 primary studies, thirty-three were published in the first decade (2001–2009) and seventy-three were published in the second decade (2010–2018). Hence, there has been > 50% increase in the number of research articles related to SOP over the last decade.

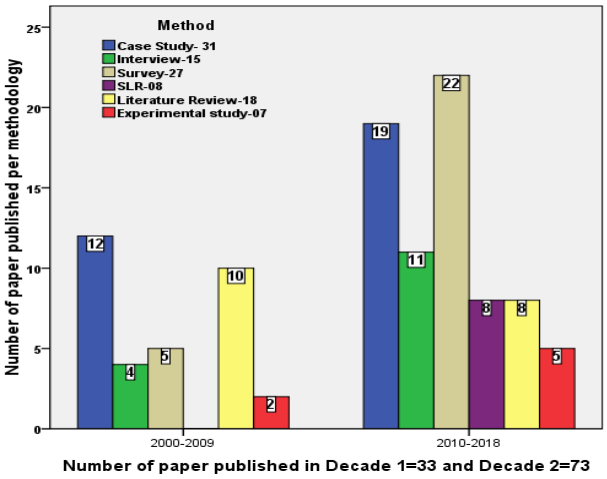


**FIGURE 4.** Decade wise distribution of the study strategy.

The selected primary studies consist of 31(29%) case studies, 15(14%) interview, 27(25%) questionnaire survey, 08(08%) SLRs, 18(17%) informal literature reviews, and 07(7%) experimental studies as shown in Figure 4. A case study is a top research methodology in the first decade while it got rank second in the second decade (2010-2018). The popularity of questionnaire based survey increases from 05% (05 cases) to 21% (22 cases) securing the top position in the second decade (2001-2018). The popularity of the interview method increases from 4% (04 cases) to 10% (11 cases) respectively. An informal literature review was 2nd most popular in the first decade from 2001 to 2009, while it is 2nd last popular in the second decade from 2010 to 2018. Its use decreases from 09% (10 cases) to 08% (08 cases) due to the popularity of the SLR in the second decade (2010-2018).

It is interesting to note that, we did not found any SLR published in the first decade (2001-2009). We only found two cases in the first decade that used action research methodology such as experiment while in the second decade we found 05 cases. The results confirm the outcomes of Shahin *et al*. [59] and Khan *et al.* [2]. The results might be beneficial for a new researcher working in the domain, interested in knowing about the relevant methodology for undertaking their research work.

### 5) STUDY STRATEGY USED IN DIFFERENT CONTINENTS

We have distributed the finally included papers into different contents based on the study strategy used. We have selected only four continents because for the other continents the count is very low. It is clear from Figure 5 that 'case study' is the most popular research methodology in 'Europe' and mixed continent studies (09 and 10 cases respectively). It is 2nd in the 'Asia' (07 cases) and 3rd in the 'America' (05 cases). 'Interview' is 3rd widely used research method in 'Europe', 4th in 'Asia' and 'America'. Interestingly it is least popular in mixed continent studies.

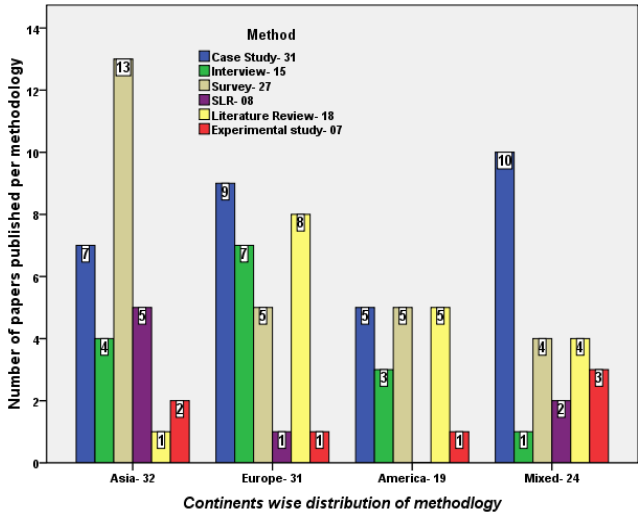


**FIGURE 5.** Distribution of study strategy into different continents.

The reason might be that due to geographic distance it is not easy to conduct interviews in the mixed continent setting. It can also be noted from Figure 5 that 'questionnaire survey' is the topmost widely used method for data gathering in 'Asia' and 'America' (13 and 05 cases respectively). It is the 2nd most popular methodology in 'mixed' content studies while 4th in 'Europe'. 'Informal literature review' is the most popular in 'America' (05 cases) and least popular in 'Asia' (only one case). The reason might be that ordinary survey papers required a high level of expertise in the relevant field.

We have found only one experimental paper in 'Europe' and 'America'. The reason might be that most of the vendors are from 'Asia' so new tools, technology, and techniques experimentation are reported in Asian literature only. It is to be noted that no 'SLR' was conducted in the paper from 'America' in the context of outsourcing. The findings of Shahin *et al.* [59] and Khan *et al*. [2] align with us.

### 6) STUDY STRATEGY USED FROM DIFFERENT PERSPECTIVE

While distributing the barriers based on the perspective of analysis, we found similarity greater than difference.

Case study, questionnaire survey, and interview are the popular research methods from an industrial perspective with 22%, 21%, and 10% popularity respectively. A case study is a top methodology from an 'industrial' perspective while 'literature review' is popular in the 'academic' group. Most of the SLR are conducted from 'academic perspective' while most of the experimental studies are conducted in the industry. Informal literature review and formal literature review (SLR)

are the most widely held research methods for data gathering at the university. The use of informal literature review in the industrial studies is 6%. The findings confirm the needs of SLRs from the industrial perspective. Details are given in Figure 6.

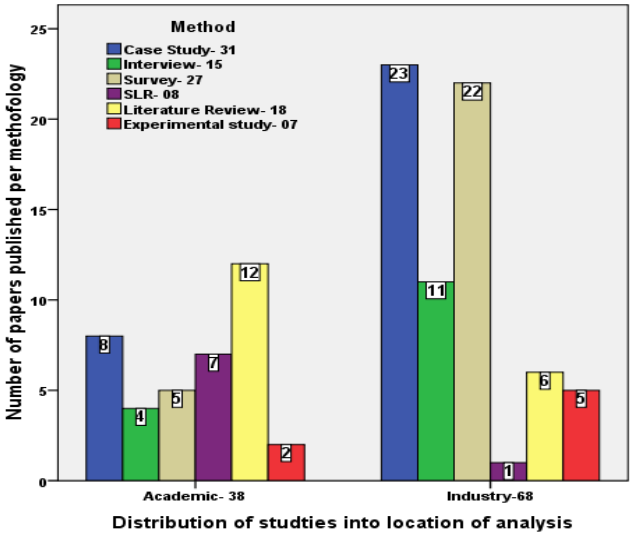


**FIGURE 6.** Distribution of study strategy into perspective.

## V. RESULTS

After getting the final sample, we extract the data from these papers. At the last stage of the data extraction phase, we extract a list of quotes from the final sample of 106 articles. Each primary investigator in discussion with the corresponding secondary investigators goes through these quotes to classify these barriers into different groups. A qualitative coding approach based on Grounded theory [60] was adopted in order to reach an initial categorization of barriers and as a result, a list of 34 groups were formed. These groups were further analyzed by external collaborator and some groups were combined. Finally, we came up with a list of twenty-six barriers as illustrated in Table 3.

### A. BARRIERS IDENTIFIED VIA SLR (RQ1)

Twenty-six barriers were identified as a result of our SLR study as listed in Table 3. In Table 3, a high percentage of a barrier shows its popularity and acknowledgment in the literature. These barriers might restrict outsourcing allies from the renovation of their existing contractual outsourcing association into an outsourcing partnership.

'Vendor opportunism and low mutual trust' is a top reported barrier in our study with 82% citation. Opportunism refers to ''lack of condor or honesty in trading, to include self-interest pursuing with guile [61]. More generally, the distorted or incomplete disclosure of information, especially to intended efforts to distort, misleads, obfuscate, confuse, or disguise [61]. Vendor opportunism in outsourcing association may take several forms, for example breaching of obligations and promises, debasement of service quality in product development or service provision, distorting or withholding information regarding the project [61]. Two kinds of vendor opportunism are protuberant in offshore software development (OSD), misappropriation of information assets (MIA) and shirking [31]. Shirking is about deteriorating to keep promises and obligations and it may have several signs of indication in OSD context. For example, an OSD vendor may intentionally reduce its effort and provide a deficient product or service, but still, claim the full remuneration [31]. MIA involves the selling or disclosing of a client's exclusive data to a competitor and use of the client's intellectual resources by a vendor for their own benefits [31]. Maintaining strong social capital and mutual trust will discourage vendor opportunism [62].

Niazi *et al.* [62], define trust as ''one party's inclination to be exposed to another party based on the faith that the later party is concerned, reliable, open, and competent''. In view of Hoecht and Trott [63], ''an agent having trust when he or she exposes himself/herself to the risk of opportunism by others and when he or she has no reason to believe that others will exploit this occasion''. Niazi *et al.* [62], confirms the positive impact of trust in the formation of software outsourcing alliance between vendor and client organizations. Lack of trust may be due to fear of opportunism like fear of losing commercially sensitive knowledge to competitors, disclosing trade secrets and hold up by vendors [12]. Or it may be due to lack of reliability, honesty, benevolence, credibility, and integrity. Or the reason might be linked to poor management of the client's expectations and transparency [12].

'Communication gap and poor client-vendor coordination' (76%) is the second most reported barrier in our study. Communication is the interchange of unambiguous and complete information while coordination is ''the act of integrating each task with each organizational unit, so the unit contributes to the overall objective. Two people have a coordination problem whenever they have common interests, or goals, and each person's actions depend on the actions of the other'' [62]. Language and culture barriers are well-known 'communication barriers' [57]. Other barriers may include poor collaboration and communication infrastructure, communication gap between client and vendors, lack of training on communication tools, and lack of synchronous communication and face-to-face meetings [64]. Various dispersion dimensions such as temporal, geographical, and work are connected with different sets of coordination challenges [65]. According to Gopal *et al.* [66], coordination may adversely affect development speed and software quality. The findings of Liu *et al.* [67], suggest that as compared to other collaboration models the offshore was more susceptible to issues of communication and coordination. In view of Dhar and Balakrishnan [68], both formal and informal communication between outsourcing associates is deliberated vigorous for the productive relationship.

**TABLE 3.** Barriers identified through systematic literature review.

| Name of barrier | F | % | Sources from which the barrier is collected |
|---|---|---|---|
| Vendor opportunism and low mutual trust | 87 | 82% | *1,6,7,8,9,10,11,12,14,15,16,17,18,20,21,23,24,27,28,29,30,32,33,34,35,36,38,39,41, 42,44,45,47,48,49,50,51,52,53,54,55,56,57,59,60,61,62,63,64,65,66,67,68,69,70,71, 72,73,74,76,77,78,79,80,81,82,83,84,85,87,88,89,92,93,94,95,96,97,98,99,100,101, 102,103,104,105,106* |
| Communication gap and poor client-vendor coordination | 81 | 76% | *1,6,7,8,9,10,11,12,14,15,16,17,18,20,21,23,24,27,28,29,30,32,33,34,35,36,38,39,41, 42,44,45,47,48,49,50,51,52,53,54,55,56.57,59,60,61, 62,63,64,65,66,67,68,69, 70, 71,72,73, 74,76,77,78,79,80,81,82,83,84,85,87,88,89,92,93,94,95,96,97,98,99,100, 101,102,103,104,105,106* |
| Relational risk and poor relationship management | 78 | 74% | *1,3,4,6,7,8,9,10,11,12,14,15,16,17,18,20,22,27,29,30,32,33,34,35,37,38,39,41,42,44, 45,47,48,49,52,53,54,55,56,58,60,62,65,66,67,68,70,71,72,73,75,76,77,79,80,81,82, 83,84,85,86,87,88,89,92,93,94,95,96,97,98,99,100,101,102,103,104,105* |
| Vendor legacy technological infrastructure and lack of technical capability | 77 | 73% | *1,4,6,8,9,10,11,12,13,14,16,18,19,20,21,24,25,27,29,30,31,33,34,35,36,37,38,39,41, 42,43,44,46,47,48,50,51,52,56,60,61,62,63,64,65,66,67,68,69,71,72,73,74,75,76,77, 78,80,81,83,85,87,88,89,91,93,94,96,97,98,99,100,102,103,104,105,106* |
| Poor quality of service and lack of co-monitoring | 75 | 71% | *1,3,4,5,6,8,9,10,12,15,16,17,18,20,22,24,27,28,30,32,33,35,36,38,40,41,44,45,47,49, 50,51,52,52,53,54,55,56,59,60,62,63,64,65,68,69,70,71, 72,73,74,75,76,77,78,79,80, 81,82,83,85,86,87,87,88,89,90,95,96,97,99,100,101,102,103,104,105* |
| Weak organizational proximity and work dispersion | 73 | 69% | *1,3,6,7,9,10,13,14,15,17,18,20,21,22,23,24,25,26,28,29,30,32,33,35,36,38,39,41,44, 45,48,49,50,51,53,54,55,56,57,58,60,61,62,63,64,65, 66,67,68,71,72,73,75,76,78,79, 80,81,82,84,86,87,88,89,92,95,97,98,99,103,104,105,106* |
| Hidden cost and high anticipated switching cost | 68 | 64% | *1,4,5,11,12,14,16,17,20,22,24,25,27,30,32,34,35,36,39,40,42,44,45,46,47,48,51,52, 53,54,56,59,60,61,62,63,66,67,68,69,70,73,74,75,76, 77,78,80,81,82,85,86,87,88, 90,91,92,93,94,95,97,98,99,102,103,104,105,106* |
| Poor contract management and enforcement | 64 | 60% | *1,2,4,6,8,9,10,11,12,16,20,22,23,24,27,28,32,33,34,35,36,38,39,44,45,48,50,51,52, 53,54,56,57,59,60,62,63,65,67,68,69,70,71,73,75,76,77,78,81,82,86,87,88,90,92,93, 95,96,97,99,100,101,103,104* |
| Poor knowledge sharing and cooperation between partner | 62 | 59% | *4,6,7,8,9,10,12,15,16,17,18,19,20,21,25,27,28,29,30,31,33,34,35,38,39,41,45,48,49, 50,51,52,53,54,55,57,58,60,62,63,64,65,66,67,70,71,73,76,79,80,82,85,87,88,92,94, 96,97,100,101,104,106* |
| Insufficient knowledge of the client activities and lack of domain training | 62 | 59% | *2,3,4,6,10,11,16,18,19,20,22,27,29,30,31,32,33,34,35,36,38,39,41,44,47,49,50,51,52, 53,54,55,57,60,62,63,65,66,67,68,69,70,73,76,77,80,82,86,87,88,89,92,95,96,97,98, 99,101,103,104,105,106* |
| Volatile requirement and no policy for change control | 52 | 49% | *1,2,3,5,6,7,9,12,14,18,21,27,30,32,33,34,38,40,41,44,45,48,50,51,52,53,56,63,65, 68,69,70,73,74,75,76,81,82,83,87,88,89,92,93,95,96,97,100,101,104,105,106* |
| Strategic inflexibility and otiose dispute resolution mechanism | 51 | 48% | *6,7,8,11,12,14,15,16,17,18,20,24,30,32,37,38,41,43,44,45,49,51,52,54,55,56,57,59, 60,61,65,66,68,71,73,74,75,76,79,80,81,82,85,88,92,97,98,101,102,103,105* |
| Poor estimation and lack of capacity to deliver product under strict time schedules | 46 | 43% | *1,6,8,9,10,12,17,18,20,27,32,34,35,37,38,39,40,41,44,51,52,53,54,56, 57,62,63, 65,67,71,73,74,75,76,77,81,82,83,87,92,95,96,97,99,103,105* |
| Geopolitical uncertainty and country instability | 45 | 43% | *1,2,3,4,5,6,8,9,10,11,12,13,14,15,16,18,21,23,32,33,35,37,38,48,51,52, 53,54,55, 56,62,63,67,72,73,75,76,79,80,82,83,87,89,92,97* |
| Misaligned goal, idiosyncratic objective and asymmetric power | 45 | 43% | *3,9,11,15,16,17,18,20,21,32,33,37,38,39,44,45,48,51,52,53,54,56,58,62,63,,65, 67,69,70,73,75,76,81,82,85,88,89,92,94,95,96,97,98,100,104* |
| Sign of uncertainty and lack of uncertainty absorption mechanism | 45 | 43% | *1,4,5,6,9,11,12,15,16,20,21,22,27,30,33,37,41,42,43,44,45,50,51,52,55,57,63,64, 68,70,73,75,77,79,80,81,82,85,86,87,95,97,101,102,106* |
| Organization inertia and lack of human capital management expertise | 44 | 42% | *1,4,6,9,10,14,15,16,20,24,26,27,28,30,33,34,36,39,43,49,50,51,53,54,56,62,65, 67,69,75,76,78,82,88,89,90,91,93,94,95,96,97,102,104* |
| Loss of capability and lack of control over project sent outside | 44 | 42% | *1,4,5,6,9,12,13,15,16,17,19,20,27,31,32,33,36,39,44,46,47,48,49,50,51, 53,54, 55,59,60,63,69,73,74,78,79,87,89,92,96,97,101,104,106* |
| Information leakage and lack of IPR protections | 37 | 35% | *1,3,6,9,12,15,16,18,19,20,33,35,44,47,49,51,53,54,55,56,57,58,59,60, 62,63,68, 71,78,80,87,92,97,99,101,104,106* |
| Integration and diffusion risk and lack of inter-firm adaptation | 36 | 34% | *1,7,9,10,11,16,17,24,26,28,31,32,33,45,47,54,55,56,57,59,60,63,64,65, 67,76,84, 87, 88,89,91,94,96,102,104,106* |
| Vendor financial instability and no relation specific investment | 36 | 34% | *1,7,9,10,12,15,23,24,29,34,37,41,45,47,50,51,52,53,54,56,57,60,61,65, 66,81, 85,87,88,89,91,95,96,97,102,105* |
| Poor project management and lack of co-management infrastructure | 30 | 28% | *3,6,9,10,12,18,27,35,36,47,48,50,51,54,56,63,64,65,68,71,73,75,76,93, 96,97, 98,99,103,105* |
| Problems stemming from organizational re-structuring | 27 | 26% | *6,8,9,10,12,16,18,21,28,33,39,44,48,49,50,53,54,56,62,81,89,93,97,98,104, 105,106* |
| Poor leadership and lack of top executive support | 27 | 26% | 1,4,6,9,11,12,16,18,20,24,28,34,36,38,39,48,49,53,55,68,70,81,88,89,97, 98,106 |
| Weak social capital and lack of social networking | 27 | 26% | 4,6,15,17,30,32,36,38,44,45,50,52,57,67,76,80,81,82,85,89,95,98,100,102, 103,104,105 |
| Client concentration and other client specific risks | 13 | 12% | 6,17,20,37,44,51,53,54,56,62,81,87,97 |

In our SLR, 74% of the authors have stated 'relational risk and poor relationship management' as a critical barrier for partnership formation. Relational risks obstruct client-vendor collaboration and thus inhibiting them from performing their responsibilities efficiently and effectively, for the attainment of mutual goals [69]. This may include lack of amenability with the contract by the vendor, deterioration of service performance, quality mishaps, service deficiencies, cost overruns, and not meeting the agreed deadlines [70], [71]. Poor relationship management may be due to lack of personnel with the capability to manage a partnership. According to Delen *et al.* [64], the reasons why outsourcing relationship fails are somehow linked to barriers such as pitiable communication, lack of capability, lack of trust, divergent goals, and poor relationship management. Abdullah and Verner [31], suggest that OSD arrangement should be made successful by avoiding relational risks like debasement of service performance and quality mishaps. Relational risk can be tackled by better management of the ongoing relationship [72]. Relationship management has a strong role in the success of software outsourcing projects [73].

Likewise, it was found that 73% of the included articles in our SLR study have declared 'insufficient quality of technical capability' and 'poor technological infrastructure' as potential hurdles for SOP. 'Technical barrier' includes task complexity, poor professional skills, lack of familiarity with the outsourced technology, and lack of research and innovative ability while 'technological barriers' may be due to organization outdated technology, lack of legacy and new system integration, and reluctance to use new technology [31], [32], [67]. Abdullah and Verner [31], mentioned experimenting with a new technology that has not been cast off in the preceding projects as a potential technical and technological risk. Samantra *et al.* [74] steered a study on risk assessment in IT outsourcing, they considered technical and technological risk as the most significant risk factor amongst all perceived risks factors. In view of Verner *et al.* [32], vendor's lack of technical capability and experience can result in failure. In view of Herath and Kishore [39], lack of technical synchronization between the client and vendor can have an adversative effect on the outsourcing association. Failure to develop competence in the technology leads vendor to a deterioration of operational capabilities and services, which results in un-satisfaction with the performance expectation of its client [75]. According to Tsai *et al.* [75], this un-satisfaction leads to relationship failure. Vendor capability risk is directly propositional to the effect of process control on performance and inversely proportional to the effectiveness of outcome control [22].

The sixth high quoted barrier (71% occurrence) in our SLR is 'poor quality of service and lack of co-monitoring. Monitoring and control are ''the process of abiding by policies, standards, goals, or quality levels'' [62]. Without effective monitoring in outsourcing, vendors may behave opportunistically and make choices, which will increase their benefit at the cost of clients [31]. Those clients who have anticipated undesirable consequences will invest constantly in monitoring and controlling the vendor's software development process and the quality of software [67]. According to Delen *et al.* [64], in some circumstances, organizations' proficiency is deplorably decreased up to half of the development effort consumed by outflows such as communication for coordination and information exchange. Now a day's organizations not only do outsourcing to utilize the cost advantages but to benefit from the improved quality that offshore vendors provide [47].

Likewise, 'organizational differences' is mentioned by 69% of the SLR sample to be an important barrier. According to Beulen [13], Global Sourcing Partnership (GSP) possesses some specific complications like culture and language differences, time zone, and work dispersion. According to Nguyen-Duc [47], work dispersion can be conceptually stated as differences in the development process, experience and expertise, working environment, development tools, standards and practices, and CMMi level of organization involved. According to Verner *et al.* [32], organizational differences, cause problems between vendor and client. Language dissimilarities between organizations can result in a wrong interpretation of the conveyed information [76]. While cultural dissimilarities create misunderstandings due to cultural bias [77]. Cultural favoritism may be more problematic when outsourcing stakeholders consider their values and norms as complete and disregarded the other's cultural norms and values [32], [47]. Søderberg *et al.* [78], suggest employing staff who have established cross-cultural understanding and capable of accurately and rapidly, sensing, interpreting, and responding to problematic situations due to cross-cultural differences.

'Hidden cost and high anticipated switching cost' is claimed by sixty-four percent of the authors in our SLR as an opposing barrier for SOP formation. Switching cost is an important factor for managerial decisions to continue or discontinue an outsourcing association [78]. Hidden costs are those costs that are not estimated or foreseen in the various phases of strategic decision making [79]. According to Larsen [79], hidden costs in offshore outsourcing includes the cost of vendor selection, the cost of layoffs, the cost of a changeover, the cost of ramping up, the cultural cost and the cost of managing an offshore contract. Hidden cost may include the costs of knowledge transfer, training, contract amendments, disputes resolution, service debasement, cost escalation, currency exchange fluctuation, and costs associated with monitoring and coordination [80]. In view of Teo and Bhattacherjee [81], software development projects require significant investments in knowledge gaining and distribution, such as giving domain specific training to vendor staff, in order to be aware of the client's corporate trade and maneuver. Such investments may have no or very little value in case of contract termination in the short run. According to Samantra *et al.* [74], high hidden and switching costs may results in potential loss and disappointment, especially

when there is no strategy specifically defined to focus on cost reduction.

Similarly, 52% of the included research papers reported 'lack of psychological contract and poor contract management' as an important barrier. By poor contract management, we mean rigid, fixed prices, inadequate, or incomplete contracting. In view of Abdullah and Verner [31], a contract will be incomplete, if it neglects post outsourcing phase and failed to specify appropriate measures like non-performance penalty. Wei *et al.* [82], suggest a psychological contract for outsourcing. The psychological contract refers to a set of expectations concerning mutual obligations between two trading partners that are not put into black and white [82]. Psychological contract theory endorses that a psychological pledge extending well beyond a mere legal contract is central to a collaborative relationship with mutual, promises, obligations, and commitments [82]. The use of inflexible and incomplete contract created further risk for both organizations [65]. Poor contract management, insufficient contracting abilities, liability outside the contract, and poor management of the relationship on specified contractual terms may lead relationship toward failure [83].

'Poor knowledge sharing management (KSM) and cooperation between partners' got 59% recognition in our SLR study. 'Poor KSM and cooperation between partners' means, lack of information flow due to non-willingness to share knowledge. The problems may be due to different levels of knowledge or problems faced in knowledge distribution [81]. The barrier is more severe when GSP involves downsizing due to resistance by the employees of the foreign client, especially to knowledge transfer [13], [36]. GSP can be an effective approach to gain access to global knowledge and reduce costs; however, researcher reports contradictory results regarding its performance effectiveness [84]. Teo and Bhattacherjee [81], consider the client's motivation, vendor's willingness, knowledge codeifiability, and client's prior experience with the vendor are important antecedents in KSM. SDO is a knowledge exhaustive activity with high task dependency, which may require the integration of tacit knowledge concerning vendor and client. Intensive communications and interactions will consume most of the software engineers' effort and times. Therefore, it necessary to properly managed knowledge sharing [81].

'Insufficient knowledge of the client activities and lack of domain training' is the last barrier in our SLR which qualifies the criteria of criticality with 59% citation. 'By this barrier, we mean 'lack of detailed understanding of the project sends to offshore, lack of a contingency plan, lack of organizational learning, and lack of training in collaboration and communication tools and functional domain. According to Verner *et al.* [32], functional knowledge is the understanding, experience, and expertise in the functional domain. According to Ryals and Rogers [85], in partnership formation merging phase might create several risks for both parties. Therefore, formal planning should be done to cope with these emerging problems and properly calculated return on investment. Functional knowledge changed from country to country. This is critical in the situation; when a client has the impression that software specifications are well understood by the offshore vendor, while the vendor does not give any feedback about their lack of understanding [84]. Therefore, domain training is necessary to cope with these issues. According to Teo and Bhattacherjee [81], in OSD projects, software specifications in most of the cases are ambiguous or incomplete. Therefore, to get familiar with the client's trade and to get functional domain knowledge domain training is obligatory.

Besides the ten CBs, we have also listed sixteen barriers such as 'strategic inflexibility and otiose dispute resolution mechanism', and 'poor estimation and lack of capacity to deliver product under strict time schedules' that have a negative role in SOP formation as shown in Table 3.

### *B. VARIATION IN THE IMPACT OF BARRIERS OVER TIME VIA TIMELINE ANALYSIS (RQ2)*

This section presents timeline analysis, in order to find significant variation in the impact of the identified barriers over time. For timeline analysis, like other researchers, we firstly distributed the finally selected papers into two decades i.e. decade-1 (2001-2009) and decade-2 (2010-2018). To see the evolution in the shorter time slots, we further compare the barriers across four periods as illustrated in Figure 7. The results found through timeline analysis are presented in the below two sub-section.

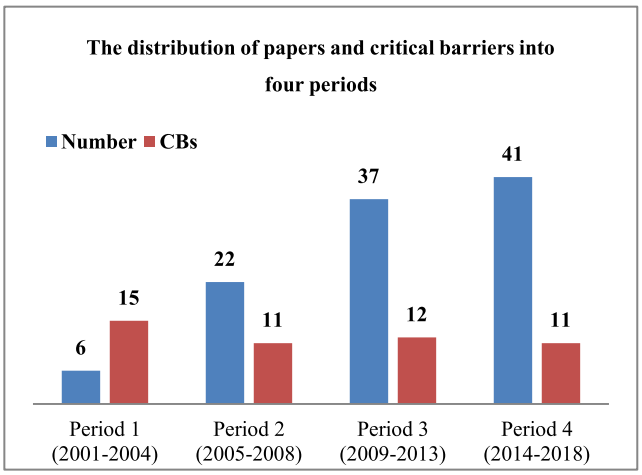


**FIGURE 7.** The distribution of papers and CBs into four periods.

#### 1) COMPARISON OF THE BARRIERS IN TWO DECADES

An overview of barriers in the two decades is presented in Table 4. The finally selected papers in the SLR are distributed into two decades based on the publication year i.e. 2001-2009 and 2010-2018. While searching for relevant publication, we did not impose any date restrictions in the search phase of the SLR. However, we found articles only in the period from 2001 till the 2018 (completion of our

**TABLE 4.** Comparison of the barriers based in two decades.

| Factors | Occurrence in SLR (N=106) | | | | Fisher's Exact Test α = 0.05 | | |
|---|---|---|---|---|---|---|---|
| | Decade One 2001-2009 (N=33) | | Decade Two 2010-2018 (N=73) | | | | |
| | f | % | f | % | $X^2$ | df | p |
| Vendor opportunism and low mutual trust | 28 | 85% | 59 | 81% | 0.248 | 1 | 0.419 |
| Communication gap and poor client-vendor coordination | 23 | 70% | 58 | 79% | 1.165 | 1 | 0.197 |
| Relational risk and poor relationship management | 25 | 76% | 53 | 73% | 0.118 | 1 | 0.465 |
| Vendor legacy technological infrastructure and lack of technical capability | 23 | 70% | 54 | 74% | 0.207 | 1 | 0.407 |
| Poor quality of service and lack of co-monitoring | 25 | 76% | 50 | 68% | 0.592 | 1 | 0.301 |
| Weak organizational proximity and work dispersion | 18 | 55% | 55 | 75% | 4.541 | 1 | 0.029 |
| Hidden cost and high anticipated switching cost | 20 | 61% | 48 | 66% | 0.260 | 1 | 0.382 |
| Poor contract management and enforcement | 20 | 61% | 44 | 60% | 0.001 | 1 | 0.574 |
| Poor knowledge sharing and cooperation between partner | 17 | 52% | 45 | 62% | 0.954 | 1 | 0.221 |
| Insufficient knowledge of the client activities and lack of domain training | 17 | 52% | 45 | 62% | 0.951 | 1 | 0.221 |
| Volatile requirement and no policy for change control | 17 | 52% | 38 | 52% | 0.003 | 1 | 0.562 |
| Strategic inflexibility and otiose dispute resolution mechanism | 15 | 45% | 36 | 49% | 0.134 | 1 | 0.438 |
| Poor estimation and lack of capacity to deliver product under strict time schedules | 16 | 48% | 30 | 41% | 0.503 | 1 | 0.308 |
| Geopolitical uncertainty and country instability | 15 | 45% | 30 | 41% | 0.176 | 1 | 0.416 |
| Misaligned goal, idiosyncratic objective and asymmetric power | 12 | 36% | 33 | 45% | 0.734 | 1 | 0.262 |
| Sign of uncertainty and lack of uncertainty absorption mechanism | 14 | 42% | 32 | 44% | 0.018 | 1 | 0.532 |
| Organization inertia and lack of human capital management expertise | 13 | 39% | 31 | 42% | 0.089 | 1 | 0.468 |
| Loss of capability and lack of control over project sent outside | 13 | 39% | 31 | 42% | 0.089 | 1 | 0.468 |
| Information leakage and lack of IPR protections | 09 | 27% | 28 | 38% | 1.258 | 1 | 0.188 |
| Integration and diffusion risk and lack of inter-firm adaptation | 11 | 33% | 25 | 34% | 0.008 | 1 | 0.555 |
| Vendor financial instability and no relation specific investment | 12 | 36% | 24 | 33% | 0.122 | 1 | 0.445 |
| Poor project management and lack of co-management infrastructure | 09 | 27% | 21 | 29% | 0.025 | 1 | 0.535 |
| Problems stemming from organizational re-structuring | 07 | 21% | 20 | 27% | 0.469 | 1 | 0.336 |
| Poor leadership and lack of top executive support | 10 | 30% | 17 | 23% | 0.578 | 1 | 0.296 |
| Weak social capital and lack of social networking | 11 | 33% | 16 | 22% | 1.515 | 1 | 0.157 |
| Client concentration and other client specific risks | **01** | **3%** | **12** | **16%** | **4.692** | **1** | **0.044** |

search phase). Comparing the barriers transversely through the two decades, as mentioned in Table 4, we came across similarities greater than differences. However, our results specify a considerable difference in the SLR sample size of the two decades. For decade-1, the sample is composed of 33 articles while for decade-2; it is 73 almost greater than twice of decade-1. One possible reason may be the greater involvement of companies in SDO partnership activities in the second decade might catch the consideration of the researchers. The findings of this study complement the previous findings in the domain, concerning the growing SOP global industry with respect to time [37], [58].

The chi-square (linear by liner version) test illustrates a noteworthy difference for two barriers 'weak organizational proximity and work dispersion' and 'client concentration and other client specific risks' for which the p-value is equal to 0.05 as shown in Table 4. This indicates that previously no attention has been given to organizational proximity. Technological, business, and cultural training from the client were not considered as a critical issue for vendors engage in SOP, but due to many failures in the 2nd decade, it is a critical risk for an organization to be successful as SOP partner. Khan and Azeem [76], consider cultural differences as a critical challenge to offshore outsourcing. Client concentration, the bigger size of the client, engaging with many clients is a new factor and only mentioned in the second decade.

The results presented in Table 4 endorse a growth in the occurrence of twelve barriers from 2001 to 2018.

We mentioned below only those eight barriers for which growth is greater than 5%.

1. Weak organizational proximity and work dispersion increased by 20%
2. Client concentration and other client specific risks increased by 13%
3. Information leakage and lack of intellectual property right protections increased by 11%

4. Ineffective knowledge transfer and cooperation between partners increased by 10%
5. Insufficient knowledge of the client activities and lack of domain training increased by 10%
6. Communication and coordination barriers increased by 9%
7. Misaligned goal, idiosyncratic objective, and asymmetric power 9%
8. Problems stemming from organizational re-structuring increased by 6%

The reason might be that these barriers become critical only in the 2nd decade (2010-2018). Therefore, both clients and vendors are advised to give serious attention to address these barriers. In the second decade SOP is practice across the globe specifically known as GSP, which give birth to these new challenges such organizational differences and dispersion, language, cultural, and communication barriers [13]. Moreover, most of the partnerships found in our SLR studies were offshore which creates problems like organizational restructuring due to the transfer of employee to counterpart country [86], intellectual property issues. Furthermore, client specific barriers like 'bigger size of client' and 'engagement with more than one client' are also increased.

According to Mukherjee *et al.* [73], offshoring gives birth to new challenges such as organizational differences and the language and cultural differences between client and vendor. Khan and Khan [83], recently identify IPR is an important challenge for software outsourcing contract management. Mukherjee *et al.* [73], advise that client must take into account intellectual property regulations in offshore outsourcing arrangements. According to them, it is very surprising that the most well-known offshoring destinations like China, India, Philippines, and Russia have maladroit legal systems and poor IPR protection.

Ineffective knowledge transfer and cooperation between partners may be due non-willingness to share knowledge and problems due to different levels of knowledge or problems faced in knowledge distribution. The risk factor is more severe when GSP involves downsizing due to resistance by the employees of the foreign client, especially to knowledge transfer [13], [36].

Teo and Bhattacherjee [81], consider client motivation, vendor willingness, knowledge codeifiability, and client prior experience with the vendor as an important knowledge codeifiability, and client prior experience with vendor as an important in KSM. According to them, SDO is knowledge exhaustive activity with high task dependency, which may require the integration of tacit knowledge concerning vendor and client. Intensive communications and interactions will consume most of the software engineers' effort and times. Therefore, it necessary to properly managed knowledge sharing [81]. The findings of Liu *et al.* [67] and Khan *et al.* [87], suggest that as compared to other collaboration models the offshore was more susceptible to issues of communication and coordination.

There is also a downward spiral in percentages for the thirteen barriers across the two decades as revealed in Table 4. However, we presented only those as an example, which are decreased by at least five 3%.

1. Weak social capital and lack of social networking decrease by 11%
2. Lack of co-monitoring and weak quality assurance by 8%
3. Poor estimation and lack of capacity to deliver product under strict time schedules down by 7%
4. Poor leadership and lack of top executive support decrees by 7%
5. Vendor opportunism and low mutual trust decreases by 4%
6. Ill-defined contract, weak contract enforcement and lack of psychological contract by 4%
7. Geopolitical risk and country instability by 4%

This may be the reason that these are no longer the first-hand hurdles for vendors in making partnerships with their software development vendors. It means these barriers are mostly covered and largely reported in the old literature of partnership. Further, it shows a positive sign that outsourcing industries become mature by addressing these risks up to some extent.

Relational dimensions of social capital can reduce internal and behavioral uncertainty between the outsourcing partners [61]. Social capital is a key to obstruct opportunism and reduced uncertainty (such as quality and delivery time) [61]. Further, it can mitigate flaws in estimation and contracting phase. Recent studies [88], [89], reports a sizeable increase in the GSP formation in the recent decade. In GPS the trust is high and the contractual control is low [12]. Mehta [90], reports that 'leadership and team management' requires proper experience to manage and lead teams, nowadays they adopted improper approaches to motivate their team members. This might mitigate the risk in the second decade. Interestingly, we found '*poor requirement capture and poor change controls'* constant 43%, in both decades.

### 2) PERIODIC DISTRIBUTION OF THE BARRIERS BASED ON TIMELINE ANALYSIS

The main purpose of the timeline analysis is to see changes over time. For timeline analysis, we distributed the finally selected papers into four groups based on the year in which the study is conducted as shown in Figure 7. It is clear from Figure 7 that the numbers of studies across these four periods are continually increasing over time. Specifically, for the first period, the sample size is 06, for second it is 22, for third it is 37 while for period four it is 41.

Comparing the barriers across the four periods as mentioned in Table 5, we found two significant differences namely 'information leakage and lack of IPR protections', 'client concentration and other client specific risks'. The percentages of these two barriers across the four periods are increasing over time as illustrated in Table 5. For instance, 'information leakage and lack of IPR protections' is not

**TABLE 5.** Comparison of the barriers across the four periods.

| Factors | Occurrence in SLR (N=106) Periods | | | | | | | | Chi-square Test (Linear-by-Linear Association) α = .05 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Period 1 (2001-2004) (N=06) | | Period 2 (2005-2008) (N=22) | | Period 3 (2009-2013) (N=37) | | Period 4 (2e014-2018) (N=41) | | | | |
| | f | % | f | % | f | % | f | % | $x^2$ | df | P |
| Vendor opportunism and low mutual trust | 04 | 67% | 20 | 91% | 28 | 76% | 35 | 85% | 0.122 | 1 | 0.726 |
| Communication gap and poor client-vendor coordination | 03 | 50% | 16 | 73% | 28 | 76% | 33 | 80% | 2.021 | 1 | 0.155 |
| Relational risk and poor relationship management | 05 | 83% | 17 | 77% | 25 | 68% | 31 | 76% | 0.078 | 1 | 0.780 |
| Vendor legacy technological infrastructure and lack of technical capability | 05 | 83% | 14 | 64% | 29 | 78% | 29 | 71% | 0.000 | 1 | 0.984 |
| Poor quality of service and lack of co-monitoring | 05 | 83% | 17 | 77% | 21 | 57% | 32 | 78% | 0.000 | 1 | 0.991 |
| Weak organizational proximity and work dispersion | 01 | 17% | 14 | 64% | 27 | 73% | 31 | 76% | 5.532 | 1 | 0.019 |
| Hidden cost and high anticipated switching cost | 04 | 67% | 13 | 59% | 25 | 68% | 26 | 63% | 0.013 | 1 | 0.910 |
| Poor contract management and enforcement | 03 | 50% | 13 | 59% | 24 | 65% | 24 | 59% | 0.029 | 1 | 0.866 |
| Poor knowledge sharing and cooperation between partner | 04 | 67% | 10 | 45% | 24 | 65% | 24 | 59% | 0.171 | 1 | 0.679 |
| Insufficient knowledge of the client activities and lack of domain training | 03 | 50% | 11 | 50% | 24 | 65% | 24 | 59% | 0.398 | 1 | 0.528 |
| Volatile requirement and no policy for change control | 02 | 33% | 11 | 50% | 19 | 51% | 23 | 56% | 0.257 | 1 | 0.612 |
| Strategic inflexibility and otiose dispute resolution mechanism | 01 | 17% | 11 | 50% | 20 | 54% | 19 | 46% | 0.318 | 1 | 0.573 |
| Poor estimation and lack of capacity to deliver product under strict time schedules | 04 | 67% | 10 | 45% | 15 | 41% | 17 | 41% | 0.760 | 1 | 0.383 |
| Geopolitical uncertainty and country instability | 03 | 50% | 09 | 41% | 15 | 41% | 18 | 44% | 0.000 | 1 | 0.995 |
| Misaligned goal, idiosyncratic objective and asymmetric power | 03 | 50% | 06 | 27% | 17 | 46% | 19 | 46% | 0.760 | 1 | 0.382 |
| Sign of uncertainty and lack of uncertainty absorption mechanism | 02 | 33% | 09 | 41% | 16 | 43% | 19 | 46% | 0.409 | 1 | 0.523 |
| Organization inertia and lack of human capital management expertise | 03 | 50% | 07 | 32% | 16 | 43% | 18 | 44% | 0.207 | 1 | 0.649 |
| Loss of capability and lack of control over project sent outside | 02 | 33% | 08 | 36% | 16 | 43% | 18 | 44% | 0.451 | 1 | 0.502 |
| Information leakage and lack of IPR protections | **00** | 0% | **06** | 27% | **14** | 38% | **17** | 41% | **3.688** | **1** | **0.055** |
| Integration and diffusion risk and lack of inter-firm adaptation | 02 | 33% | 07 | 32% | 13 | 35% | 14 | 34% | 0.020 | 1 | 0.888 |
| Vendor financial instability and no relation specific investment | 02 | 33% | 08 | 36% | 15 | 41% | 11 | 27% | 0.582 | 1 | 0.445 |
| Poor project management and lack of co-management infrastructure | 01 | 17% | 07 | 32% | 10 | 27% | 12 | 29% | 0.059 | 1 | 0.809 |
| Problems stemming from organizational re-structuring | 00 | 0% | 05 | 23% | 11 | 30% | 11 | 27% | 1.072 | 1 | 0.300 |
| Poor leadership and lack of top executive support | 01 | 17% | 06 | 27% | 13 | 35% | 07 | 17% | 0.467 | 1 | 0.494 |
| Weak social capital and lack of social networking | 03 | 50% | 08 | 36% | 06 | 16% | 10 | 24% | 2.017 | 1 | 0.156 |
| Client concentration and other client specific risks | **00** | 0% | **00** | 0% | **04** | 11% | **09** | 22% | **7.051** | **1** | **0.008** |

recognized as a barrier in the 1st period (2001-2004), while its percentage reaches from 27% to 41% from 2005 to 2018. The reason might be that 'data leakage and lack of IPR protection is mostly related to offshoring and offshoring got momentum in the recent past that is why its popularity increases over time.

Mukherjee *et al.* [73], advise that client must take into account intellectual property regulations in offshore outsourcing arrangements. According to them, it is very surprising that the most well-known offshoring destinations like China, India, Philippines, and Russia have maladroit legal systems and poor IPR protection. Client concentration, bigger size of the client, engaging with many clients is a new factor and only mentioned in the last two periods only. We did not find any study for comparison in connection to timeline analysis for 'client concentration'.

We found all the ten general CBs in Table 3, commonly critical across the four periods except 'weak organizational proximity and work dispersion' and 'poor knowledge sharing and cooperation between partner'. The former is not critical in the 1st decade while the latter is not critical in the 2nd period. The reason might be that these two factors are related to offshoring which become popular in the recent decade (in the last two periods). According to Ajitkumar [69], the global outsourcing market has shown extraordinary growth in the current few years. Outsourcing deals have grown up in complexity, significance, and size. This has stemmed in a bigger concern with project management, knowledge management

**TABLE 6. Comparison of barriers based on company sizes.**

| Barriers | Occurrence in SLR (N=106) | | | | | | | | Chi-square Test (Linear-by-Linear Association) α = .05 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Company size | | | | | | | | | | |
| | Small (N=07) | | Medium (N=18) | | Large (N=59) | | Mixed (N=22) | | | | |
| | f | % | F | % | F | % | f | % | $x^2$ | df | P |
| Vendor opportunism and low mutual trust | 04 | **57%** | 15 | **83%** | 49 | **83%** | 19 | **86%** | 1.778 | 1 | 0.182 |
| Communication gap and poor client-vendor coordination | 03 | 43% | 15 | **83%** | 47 | **80%** | 15 | **68%** | 0.191 | 1 | 0.662 |
| Relational risk and poor relationship management | 05 | **71%** | 12 | **67%** | 45 | **76%** | 16 | **73%** | 0.140 | 1 | 0.708 |
| Vendor legacy technological infrastructure and lack of technical capability | 05 | **71%** | 11 | **61%** | 43 | **73%** | 18 | **82%** | 1.352 | 1 | 0.245 |
| Poor quality of service and lack of co-monitoring | 05 | **71%** | 11 | **61%** | 44 | **75%** | 15 | **68%** | 0.083 | 1 | 0.774 |
| Weak organizational proximity and work dispersion | 04 | **57%** | 10 | **56%** | 43 | **73%** | 16 | **73%** | 1.645 | 1 | 0.200 |
| Hidden cost and high anticipated switching cost | 04 | **57%** | 12 | **67%** | 36 | **61%** | 16 | **73%** | 0.375 | 1 | 0.540 |
| Poor contract management and enforcement | 05 | **71%** | 10 | **56%** | 38 | **64%** | 11 | **50%** | 0.542 | 1 | 0.462 |
| Poor knowledge sharing and cooperation between partner | 02 | 29% | 09 | **50%** | 37 | **63%** | 14 | **64%** | 2.854 | 1 | 0.091 |
| Insufficient knowledge of the client activities and lack of domain training | 05 | **71%** | 13 | **72%** | 33 | **56%** | 11 | **50%** | 2.302 | 1 | 0.129 |
| Volatile requirement and no policy for change control | 03 | 43% | 10 | **56%** | 32 | **54%** | 10 | 45% | 0.039 | 1 | 0.844 |
| Strategic inflexibility and otiose dispute resolution mechanism | 03 | 43% | 08 | 44% | 29 | 49% | 11 | **50%** | 0.194 | 1 | 0.659 |
| Poor estimation and lack of capacity to deliver product under strict time schedules | 04 | 57% | 07 | 39% | 36 | **61%** | 09 | 41% | 0.166 | 1 | 0.684 |
| Geopolitical uncertainty and country instability | 03 | 43% | 06 | 33% | 28 | 47% | 08 | 36% | 0.004 | 1 | 0.952 |
| Misaligned goal, idiosyncratic objective and asymmetric power | 03 | 43% | 09 | 50% | 24 | 41% | 09 | 41% | 0.186 | 1 | 0.666 |
| Sign of uncertainty and lack of uncertainty absorption mechanism | 03 | 43% | 08 | 44% | 25 | 42% | 10 | 45% | 0.007 | 1 | 0.0934 |
| Organization inertia and lack of human capital management expertise | 03 | 43% | 07 | 39% | 25 | 42% | 09 | 41% | 0.001 | 1 | 0.970 |
| Loss of capability and lack of control over project sent outside | 03 | 43% | 07 | 39% | 25 | 42% | 09 | 41% | 0.001 | 1 | 0.097 |
| Information leakage and lack of IPR protections | 00 | 0% | 06 | 33% | 23 | 39% | 23 | 36% | 1.960 | 1 | 0.162 |
| Integration and diffusion risk and lack of inter-firm adaptation | 03 | 43% | 09 | 50% | 14 | 24% | 10 | 45% | 0.169 | 1 | 0.681 |
| Vendor financial instability and no relation specific investment | 01 | 14% | 09 | 50% | 16 | 27% | 10 | 45% | 0.378 | 1 | 0.539 |
| Poor project management and lack of co-management infrastructure | 02 | 29% | 02 | 11% | 19 | 32% | 07 | 32% | 1.068 | 1 | 0.301 |
| Problems stemming from organizational re-structuring | 00 | 0% | 02 | 11% | 20 | 34% | 05 | 23% | 2.394 | 1 | 0.122 |
| Poor leadership and lack of top executive support | 00 | 0% | 04 | 22% | 18 | 31% | 05 | 23% | 0.979 | 1 | 0.322 |
| Weak social capital and lack of social networking | 02 | 29% | 06 | 33% | 13 | 22% | 06 | 27% | 0.164 | 1 | 0.685 |
| Client concentration and other client specific risks | 00 | 0% | 00 | 0% | 09 | 15% | 04 | 18% | 3.750 | 1 | 0.053 |

in the outsourcing venture, and specifically with the subjects matters of risk and risk mitigation. Khan and Azeem [76], consider cultural differences as a critical challenge to offshore outsourcing. According to Mukherjee *et al.* [73], offshoring gives birth to new challenges such as organizational differences and the language and cultural differences between client and vendor. We found seven barriers such that their recognition increases with the passage of time. These are:

- Communication gap and poor client-vendor coordination (50%, 73%, 76%, and 80%)
- Weak organizational proximity and work dispersion (17%, 64%, 73%, and 76%)
- c Volatile requirement and no policy for change control (33%, 50%, 51%, and 56%)
- Sign of uncertainty and lack of uncertainty absorption mechanism (33%, 41%, 43%, and 46%)
- Loss of capability and lack of control over project sent outside (33%, 36%, 43%, and 44%)
- Information leakage and lack of IPR protections (0%, 27%, 38%, and 41%)
- Client concentration and other client specific risks (0%, 0%, 11%, and 22%)

There is also a downward spiral in the criticality of one barrier i.e. poor estimation and lack of capacity to deliver product under strict time schedules (67%, 45%, 41%, and 41%). The reason might be that due to organizational training on cost estimation tools, the impact of the barrier is reducing with the passage of time, but is not completely eliminated. Erickson and Ranganathan [29] have described the case of one SDO project which completely failed due to the problems with meeting expectations of the client on schedule, budget, and quality.

### C. BARRIERS CRITICAL IN SMALL, MEDIUM, AND LARGE ORGANIZATIONS(RQ3)

Out of 106, only 90 papers have clearly stated the company size as presented in Table 6. For the remaining sixteen articles, we have consulted the authors to get feedback about company size. We considered literature review as large by default. Refereeing to the definition of Australian Bureau

of Statistics [91], we had divided the sample articles into four categories: Company with 0 to 19 workers are consider 'SMALL', with 20 to 199 workers are term is 'MEDIUM', 200 plus worker are put into 'LARGE'. For analysis purpose, outsourcing between any combinations of the three are referred to as 'Mixed'.

As shown in Table 6, 22 out of 26 barriers are mentioned in the research article related to 'SMALL' size organization. The remaining four barriers have zeros frequency in the 'SMALL' category. These barriers are 'information leakage and lack of IPR protections', 'problems stemming from organizational structure', 'poor leadership and lack of top executive support', and 'client specific barriers' like engaging with more than one clients and bigger size of the client. The reason might be that small organization's data is not sensitive as compared to large organizations; therefore, it is not reported in the literature. Social capital helps in establishing long terms relationships while active leadership and their strong support helps in the establishment of partnership. Furthermore, client concentration restricts vendors to only one client. Since small organization only does small projects and does not focus on long terms relationship, thus it is not a well-known barrier to small vendors.

Among these twenty-two barriers, eight barriers have been reported with frequency >= 50% as shown in Table 6. It is to be noted that the five barriers 'relational risk and poor relationship management', 'vendor legacy technological infrastructure and lack of technical capability', 'poor quality of service and lack of co-monitoring', 'poor contract management and enforcement', and 'insufficient knowledge of the client activities, and lack of domain training haves the highest citation 71% in the small organization. The reason might be that to convert the existing contract based relationship into partnership with client organization vendors need to change old style techniques and technology, arrange domain training to increase quality of service and ultimately establishes a good relationship with their client. Moreover, two CBs 'vendor opportunism and low mutual trust', 'weak organizational proximity and work dispersion and 'hidden cost and high anticipated switching cost' are cited with 57% in our SLR study. This indicates that these barriers are also perilous for small size organizations in the context of SOP. These barriers are mostly related to the pre-partnership phase, this might be the cause that small corporate are at the very first phase towards SOP establishment.

Concerning 'medium' size organizations, 25 out of 26 barriers are mentioned in the research article related to 'medium', as shown in Table 6. The remaining one barrier has zero frequency in the 'medium' category. This barrier is 'client specific barriers' like engaging with more than one client and bigger size of the client. The reason might be that small and medium organizations have not faced such problems. Therefore, it is not reported in the literature.

Among these twenty-six barriers, eleven barriers have been reported with frequency >= 50% as shown in Table 6. It is to be noted that the barriers 'vendor opportunism and low mutual trust' and 'communication gap and poor client-vendor coordination' have got highest citation 83% in the 'medium' category. The reason might be that in order to convert the existing contract based relationship into partnership with the client organization vendors need to improve communication with the client, which will ultimately increase trust and will discourage opportunism. 'Insufficient knowledge of the client activities and lack of domain training – 72%' is the second top barrier in the medium group. 'Relational risk and poor relationship management' and 'hidden cost and high anticipated switching cost' both are the 3rd level (67%) inhibitor to partnership formation or contract renewal to medium size organization 'Vendor legacy technological infrastructure and lack of technical capability' and 'poor quality of service and lack of co-monitoring (61%) are ranked fourth. Moreover, the CBs, 'weak organizational proximity and work dispersion, 'poor contract management and enforcement', and 'volatile requirement and no policy for change control have more than fifty percent (56%) quotes in medium organization. Poor knowledge sharing and cooperation between partners got exactly 50% recognitions. This indicates that these barriers are also perilous for medium enterprises in the context of SOP. This might be the cause that medium is readiness phase towards SOP establishment [92].

Concerning larger organizations, all the listed barriers are also found in the selected literature related to the large organization. Twelve barriers have been cited in >=50% in the finally selected manuscripts. 'Vendor opportunism and low mutual trust -83%, 'Communication gap and poor client-vendor coordination -80%', and 'Relational risk and poor relationship management -76%', are the top three barriers in the large organization. All the critical barriers in our study are also critical in the large size organization. This confirms that SOP is largely formed in large organizations. Kinnula *et al.* [8], also reports that in the direction to outsource non-core activity large SDOs are moving from contractual relationship towards partnership.

The two barriers, critical in large but not as general (see Table 3) are 'poor estimation and lack of capacity to deliver product under strict time schedules' and 'volatile requirement and no policy for change control' with percentages 61% and 54% respectively as shown in Table 6.

Related to mixed type, we also found all the barriers in the relevant literature of mixed category. Eleven barriers have been cited in >=50% of the final sample of articles. Top three cited factors are, 'vendor opportunism and low mutual trust -86%, 'vendor legacy technological infrastructure and lack of technical capability -86%, and 'relational risk and poor relationship management', 'weak organizational proximity and work dispersion' 'hidden cost and high anticipated switching cost with percentage, '73%', respectively. Other most cited barriers are 'communication gap and poor client-vendor coordination', 'poor quality of service and lack of co-monitoring' with 68%, recognition in the literature. The one barrier which is not critical as general (see Table 3) but critical in the mixed category is 'strategic inflexibility and

**TABLE 7.** Comparison of the barriers across various continents.

| Factors | Occurrence in SLR (N=106) | | | | | | | | Chi-square Test (Linear-by-Linear Association) α = .05 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Continent | | | | | | | | | | |
| | Asia (N=32) | | Europe (N=31) | | America (N=19) | | Mixed (N=24) | | | | |
| | f | % | f | % | f | % | f | % | $x^2$ | df | P |
| Vendor opportunism and low mutual trust | 29 | **91%** | 26 | **84%** | 13 | **68%** | 19 | **79%** | 2.249 | 1 | 0.134 |
| Communication gap and poor client-vendor coordination | 28 | **88%** | 24 | **77%** | 10 | **53%** | 19 | **79%** | 1.846 | 1 | 0.174 |
| Relational risk and poor relationship management | 27 | **84%** | 22 | **71%** | 14 | **74%** | 15 | **63%** | 2.884 | 1 | 0.089 |
| Vendor legacy technological infrastructure and lack of technical capability | 23 | **72%** | 23 | **74%** | 12 | **63%** | 19 | **79%** | 0.091 | 1 | 0.762 |
| Poor quality of service and lack of co-monitoring | 24 | **75%** | 23 | **74%** | 13 | **68%** | 15 | **63%** | 1.174 | 1 | 0.279 |
| Weak organizational proximity and work dispersion | **26** | **81%** | **23** | **74%** | **10** | **53%** | **14** | **58%** | **4.997** | **1** | **0.025** |
| Hidden cost and high anticipated switching cost | 19 | **59%** | 21 | **68%** | 11 | **58%** | 17 | **71%** | 0.400 | 1 | 0.527 |
| Poor contract management and enforcement | 19 | **59%** | 20 | **65%** | 11 | **58%** | 14 | **58%** | 0.039 | 1 | 0.843 |
| Poor knowledge sharing and cooperation between partner | 24 | **75%** | 16 | **52%** | 09 | 47% | 13 | **54%** | 2.702 | 1 | 0.100 |
| Insufficient knowledge of the client activities and lack of domain training | 20 | **63%** | 17 | **55%** | 09 | 47% | 16 | **67%** | 0.008 | 1 | 0.927 |
| Volatile requirement and no policy for change control | 16 | **50%** | 19 | **61%** | 07 | 37% | 13 | **54%** | 0.039 | 1 | 0.843 |
| Strategic inflexibility and otiose dispute resolution mechanism | 19 | **59%** | 12 | 39% | 10 | **53%** | 10 | 42% | 0.999 | 1 | 0.318 |
| Poor estimation and lack of capacity to deliver product under strict time schedules | 17 | **53%** | 11 | 35% | 08 | 42% | 10 | 42% | 0.522 | 1 | 0.470 |
| Geopolitical uncertainty and country instability | 16 | **50%** | 12 | 39% | 06 | 32% | 11 | 46% | 0.245 | 1 | 0.621 |
| Misaligned goal, idiosyncratic objective and asymmetric power | 16 | **50%** | 14 | 45% | 06 | 32% | 09 | 38% | 1.408 | 1 | 0.235 |
| Sign of uncertainty and lack of uncertainty absorption mechanism | 13 | 41% | 09 | 29% | 13 | **68%** | 11 | 46% | 1.381 | 1 | 0.240 |
| Organization inertia and lack of human capital management expertise | 12 | 38% | 14 | 45% | 08 | 42% | 10 | 42% | 0.065 | 1 | 0.789 |
| Loss of capability and lack of control over project sent outside | 11 | 34% | 14 | 45% | 08 | 42% | 11 | 46% | 0.602 | 1 | 0.438 |
| Information leakage and lack of IPR protections | 10 | 31% | 09 | 29% | 07 | 37% | 11 | 46% | 1.481 | 1 | 0.224 |
| Integration and diffusion risk and lack of inter-firm adaptation | 11 | 34% | 12 | 39% | 05 | 26% | 08 | 33% | 0.116 | 1 | 0.733 |
| Vendor financial instability and no relation specific investment | 09 | 28% | 10 | 32% | 07 | 37% | 10 | 42% | 1.219 | 1 | 0.270 |
| Poor project management and lack of co-management infrastructure | 09 | 28% | 10 | 32% | 04 | 21% | 07 | 29% | 0.030 | 1 | 0.863 |
| Problems stemming from organizational re-structuring | 08 | 25% | 10 | 32% | 03 | 16% | 06 | 25% | 0.141 | 1 | 0.707 |
| Poor leadership and lack of top executive support | 11 | 34% | 09 | 29% | 03 | 16% | 04 | 17% | 3.062 | 1 | 0.080 |
| Weak social capital and lack of social networking | 06 | 19% | 11 | 35% | 06 | 32% | 04 | 17% | 0.032 | 1 | 0.857 |
| Client concentration and other client specific risks | 04 | 13% | 03 | 10% | 02 | 11% | 04 | 17% | 0.198 | 1 | 0.656 |

otiose dispute resolution mechanism. The reason might be that chances of dispute occurrence are more in imbalance venture as compared to balance venture in which one organization is small and other is either medium or small.

*We did not acknowledge any significant difference across company size as shown in Table 6.* It may be due to the trifling sample for the 'small' category. The results confirm the findings of Khan *et al.* [2].

### D. COMPARISON OF THE BARRIERS ACROSS VARIOUS CONTINENTS (RQ4)

In this paper, we have only associated the barriers found in four continents categories i.e. Asia, America, Europe, and Mixed (a combination of two or more). This analysis aims to discover whether the identified barriers vary from continent to continent. We argue that knowing about the differences and similarities across continents in the identified barriers can add to the existing knowledge of SOP. This is for the reason that manuscripts from different continents mentioned that barriers producing a negative impression on the client organizations must be addressed totally by the vendor organizations in that specific continent. Due to the categorical nature of the data linear by linear association Chi-Square test was preferred to use for finding the significant differences between barriers identified in the three continents plus mixed continent perspective.

For analysis of the significant differences amongst nominal and ordinal variables, the linear by linear chi-square test is considered more powerful as compared to Pearson chi-square test [93]. By comparing the barriers across these continents categories, we have brought into being only one substantial variation in the distribution of barriers among the continents as given below and shown in Table 7 for which p-value is less than 0.05.

*'Weak organizational proximity and work dispersion (81%, 74%, 53%, and 58%)*

The barrier percentage is high in 'Asia' and 'Europe'. The reason might be that 'work dispersion and organizational

proximity problems are more sever to the vendor as compared to a client. Since most of the vendors are from 'Asia', therefore the barrier is reported with a high percentage. Further, European countries preferred onshore and nearshore over offshore because of the greater proximity in onshore and nearshore. As shown in Table 7, all twenty-six barriers are mentioned in the research article related to the continent 'Asia'. As revealed in Table 7, more than half of the barriers have been reported with frequency >= 50%. It is noted from Table 7 that 'opportunism and lack of trust -91%', 'communication gap and poor client-vendor coordination -88%', and 'relational risk and poor relationship management -84% are the top three cited CB in 'Asia'. 'Poor quality of service and lack of co-monitoring' and 'poor knowledge sharing and management' having 75% reputations in the relevant literature are the second priority CBs for vendors in 'Asia'. This shows that to convert the existing contract based relationship into partnership with a client for future outsourcing projects vendors from Asia need to gain the trust of the client and should be more open and transparent. Further, they need to develop organization symmetry by better coordination and collaboration with the client through the latest communication technology. Additionally, they need to advance the quality of service and product by upgrading technology and skill, and through better monitoring and control.

For the 'Europe' continent, we had also found all the listed barriers from relevant literature. Eleven barriers have been cited in >=50% in the finally selected articles. 'Opportunism and lack of trust' having 84% general recognition while 'communication gap and poor client-vendor coordination' having the 2nd highest percentage 77%. 'Vendor legacy technological infrastructure and lack of technical capability', 'poor quality of service and lack of co-monitoring', and 'weak organizational proximity and work dispersion all three are equally reported (74%) in the literature related to 'Europe category. Other most cited barriers are 'relational risk and poor relationship management -71%' and 'hidden cost and poor cost control -68%', and 'poor contract management and enforcement – 65%.

From 'American' perspective, all the identified barriers are reported in the literature. Ten barriers have been cited with >=50% in the finally selected manuscripts. 'Relational risk and poor relationship management -74%' is the top while 'vendor opportunism and low mutual trust', and 'poor quality of service and lack of co-monitoring' are the second top CBs with count 68% which restrict vendors in 'America' continent to engage in the SOP. Barriers on the third rank are 'vendor legacy technological infrastructure and lack of technical capability'. Other highly cited (58%) barriers are 'hidden cost and high anticipated switching' and 'poor contract management and enforcement'.

For mix continent studies, we also found all barriers in the finally collected articles. Similar to 'Europe' eleven barriers have been cited in >=50% of the articles. 'Vendor opportunism and low mutual trust', 'communication gap and poor client-vendor coordination', 'vendor legacy technological infrastructure and lack of technical capability, are the top CBs with count 79% which restrict both client and vendor to engage in the SOP. 'Hidden cost and high anticipated switching cost -71%' and 'insufficient knowledge of the client activities and lack of domain training -67% are the 2nd and 3rd rank barriers. Other highly cited (63%) barriers are 'relational risk and poor relationship management' and 'poor quality of service and lack of co-monitoring'.

### E. BARRIERS BASED ON THE LOCATION OF ANALYSIS PERSPECTIVE (RQ5)

Out of 106, only 101 articles have mentioned the perspective as shown in Table 8. For the remaining five articles, we have contacted the authors to get feedback about the perspective of analysis. We counted literature review from the academic perspective by default if the paper is not written by the industrial author. As shown in Table 8, all barriers are mentioned in the research article related to 'Academic' perspective. 'Vendor opportunism and low mutual trust' and 'relational risk and poor relationship management' are the topmost barriers from an academic perspective with a count of 82%. 'Communication gap and poor client-vendor coordination', and 'Vendor legacy technological infrastructure and lack of technical capability' are the second and 3rd lever huddles form academic perspective with citation 76% and 74% respectively as shown in Table 8. Eleven barriers were considered critical from an academic perspective. All the generally critical barriers are also critical from an academic perspective. The one barrier, which is not critical as a general in Table 3 but is critical from an 'academic perspective', is 'sign of uncertainty and lack of uncertainty absorption mechanism''.

For 'Industry' as a location of analysis, we also found all barriers.

'Vendor opportunism and low mutual trust' is the number one barrier concerning citation count 82%. 'Communication gap and poor client-vendor coordination', and 'vendor legacy technological infrastructure and lack of technical capability' are the second and third most cited CBs with count 76% and 75% respectively. To know about the inter-rater reliability (significant correlation) between the two perspectives, we have administered Fisher's exact test.

We did not identify any significant variations across the two perspectives (academic, practitioner) for the identified 26 barriers as shown in Table 8. From practitioner perspective, we also found eleven barriers as CBs. All the CBs in Table 8 are also critical in the industry. The one barrier which is not critical as general but critical from practitioner perspective is 'requirement management issues.

### F. DISTRIBUTION OF BARRIERS FROM CLIENT-VENDOR PERSPECTIVE (RQ6)

We divide the finally selected articles into 3 perspectives. Studies which are conducted from Client viewpoints are grouped into 'client' perspective while studies from vendor viewpoint are count into 'vendor' perspective. Studies in

**TABLE 8.** Comparison of the barriers from two locations of analysis perspectives.

| Factors | Occurrence in SLR (N=106) | | | | Fisher's Exact Test α = 0.05 | | |
|---|---|---|---|---|---|---|---|
| | Academic (N=38) | | Industry (N=68) | | | | |
| | Freq | % | Freq | % | $X^2$ | df | p |
| Vendor opportunism and low mutual trust | 31 | **82%** | 56 | **82%** | 0.010 | 1 | 0.559 |
| Communication gap and poor client-vendor coordination | 29 | **76%** | 52 | **76%** | 0.000 | 1 | 0.583 |
| Relational risk and poor relationship management | 31 | **82%** | 47 | **69%** | 2.023 | 1 | 0.121 |
| Vendor legacy technological infrastructure and lack of technical capability | 26 | **68%** | 51 | **75%** | 0.525 | 1 | 0.306 |
| Poor quality of service and lack of co-monitoring | 28 | **74%** | 47 | **69%** | 0.248 | 1 | 0.396 |
| Weak organizational proximity and work dispersion | 25 | **66%** | 48 | **71%** | 0.259 | 1 | 0.382 |
| Hidden cost and high anticipated switching cost | 25 | **66%** | 43 | **63%** | 0.069 | 1 | 0.482 |
| Poor contract management and enforcement | 25 | **66%** | 39 | **57%** | 0.732 | 1 | 0.261 |
| Poor knowledge sharing and cooperation between partner | 22 | **58%** | 40 | **59%** | 0.009 | 1 | 0.543 |
| Insufficient knowledge of the client activities and lack of domain training | 21 | **55%** | 41 | **60%** | 0.253 | 1 | 0.382 |
| Volatile requirement and no policy for change control | 16 | 42% | 39 | **57%** | 2.276 | 1 | 0.096 |
| Strategic inflexibility and otiose dispute resolution mechanism | 17 | 45% | 33 | 48% | 0.141 | 1 | 0.432 |
| Poor estimation and lack of capacity to deliver product under strict time schedules | 16 | 42% | 30 | 44% | 0.040 | 1 | 0.503 |
| Geopolitical uncertainty and country instability | 18 | 47% | 27 | 40% | 0.584 | 1 | 0.287 |
| Misaligned goal, idiosyncratic objective and asymmetric power | 14 | 37% | 31 | 46% | 0.769 | 1 | 0.253 |
| Sign of uncertainty and lack of uncertainty absorption mechanism | 20 | **53%** | 26 | 38% | 2.051 | 1 | 0.110 |
| Organization inertia and lack of human capital management expertise | 16 | 42% | 28 | 41% | 0.009 | 1 | 0.543 |
| Loss of capability and lack of control over project sent outside | 14 | 37% | 30 | 44% | 0.535 | 1 | 0.301 |
| Information leakage and lack of IPR protections | 16 | 42% | 21 | 31% | 1.337 | 1 | 0.171 |
| Integration and diffusion risk and lack of inter-firm adaptation | 15 | 39% | 21 | 31% | 0.795 | 1 | 0.247 |
| Vendor financial instability and no relation specific investment | 10 | 26% | 26 | 38% | 1.577 | 1 | 0.152 |
| Poor project management and lack of co-management infrastructure | 10 | 26% | 20 | 29% | 0.114 | 1 | 0.458 |
| Problems stemming from organizational re-structuring | 12 | 32% | 15 | 22% | 1.143 | 1 | 0.198 |
| Poor leadership and lack of top executive support | 12 | 32% | 15 | 22% | 1.143 | 1 | 0.198 |
| Weak social capital and lack of social networking | 06 | 42% | 21 | 31% | 3.084 | 1 | 0.067 |
| Client concentration and other client specific risks | 05 | 13% | 08 | 12% | 0.044 | 1 | 0.530 |

which both client and vendor relationships were discussed are put into 'Both' group as shown in Table 9.

From the 'client' perspective, we identify fourteen barriers as CBs. All the critical barriers in Table 9 are also critical from the 'Client' perspective. Four barriers 'strategic inflexibility and otiose dispute resolution mechanism -68%', 'high staff turnover and lack of human capital management expertise 59%', 'lack of control over project -55%', and 'sign of uncertainty and lack of uncertainty absorption mechanism -50%' are found critical from 'Client' perspective but are not critical as general in Table 9. 'Vendor opportunism and low mutual trust -91%', 'poor quality of service and lack of co-monitoring -86%', and 'relational risk and poor relationship management' are considered the top three barriers from vendor viewpoint. From the 'vendor' perspective, we found fifteen barriers as critical barriers. All the ten critical barriers in Table 3 are also critical from the 'vendor' perspective. Five barriers which are critical from 'vendor' viewpoint but not critical as general in Table 9 are 'requirement management issues -66%', 'geopolitical risk and country instability -60%', 'poor estimation and lack of capacity to deliver product under strict time schedules -51%', and Information leakage and lack of IPR protections -51%. 'Poor quality of service and lack of co-monitoring -83%' are the topmost barrier while 'vendor opportunism and low mutual trust' and 'vendor legacy technological infrastructure and lack of technical capability' are the second level barriers from vendor perspective with a citation count of 80%.

From 'Both' client-vendor combined perspective we notice that all the barriers which are critical from both 'Client' and 'Vendor' perspective are also critical from 'both' perspective'. Due to the categorical nature of the data linear by linear association Chi-Square test was preferred to use for finding the significant differences between barriers identified in the three perspectives.

For analysis of the significant differences amongst nominal and ordinal variables, the linear by linear chi-square test is considered more powerful as compared to the Pearson chi-square test [93]. By comparing the barriers across these three categories, we have brought into being two substantial

**TABLE 9.** Comparison of the factors on client vendor's perspective.

| Barriers | Occurrence in SLR (N=106) Company size | | | | | | Chi-square Test (Linear-by-Linear Association) α = .05 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Client (N=22) | | Vendor (N=35) | | Both (N=49) | | | | |
| | F | % | F | % | F | % | $x^2$ | df | P |
| Vendor opportunism and low mutual trust | 20 | **91%** | 28 | **80%** | 39 | **80%** | 1.049 | 1 | 0.306 |
| Communication gap and poor client-vendor coordination | 16 | **73%** | 27 | **77%** | 38 | **78%** | 0.160 | 1 | 0.689 |
| Relational risk and poor relationship management | 18 | **82%** | 25 | **71%** | 35 | **71%** | 0.654 | 1 | 0.419 |
| Vendor legacy technological infrastructure and lack of technical capability | 17 | **77%** | 21 | **60%** | 39 | **80%** | 0.443 | 1 | 0.506 |
| Poor quality of service and lack of co-monitoring | **19** | **86%** | **29** | **83%** | **27** | **55%** | **9.205** | **1** | **0.002** |
| Weak organizational proximity and work dispersion | 15 | **68%** | 27 | **77%** | 31 | **63%** | 0.485 | 1 | 0.486 |
| Hidden cost and high anticipated switching cost | 15 | **68%** | 21 | **60%** | 32 | **65%** | 0.007 | 1 | 0.934 |
| Poor contract management and enforcement | 14 | **64%** | 23 | **66%** | 27 | **55%** | 0.704 | 1 | 0.401 |
| Poor knowledge sharing and cooperation between partner | 11 | **50%** | 21 | **60%** | 30 | **61%** | 0.655 | 1 | 0.418 |
| Insufficient knowledge of the client activities and lack of domain training | 15 | **68%** | 20 | **57%** | 27 | **55%** | 0.915 | 1 | 0.339 |
| Volatile requirement and no policy for change control | 10 | 45% | 23 | **66%** | 22 | 45% | 0.250 | 1 | 0.617 |
| Strategic inflexibility and otiose dispute resolution mechanism | 11 | **50%** | 17 | 49% | 23 | 47% | 0.061 | 1 | 0.805 |
| Poor estimation and lack of capacity to deliver product under strict time schedules | 08 | 36% | 18 | **51%** | 20 | 41% | 0.005 | 1 | 0.943 |
| Geopolitical uncertainty and country instability | 08 | 36% | 21 | **60%** | 16 | 33% | 0.758 | 1 | 0.384 |
| Misaligned goal, idiosyncratic objective and asymmetric power | 10 | 45% | 18 | **51%** | 17 | 35% | 1.259 | 1 | 0.262 |
| Sign of uncertainty and lack of uncertainty absorption mechanism | 11 | **50%** | 15 | 43% | 20 | 41% | 0.464 | 1 | 0.496 |
| Organization inertia and lack of human capital management expertise | 13 | **59%** | 11 | 31% | 20 | 41% | 1.126 | 1 | 0.289 |
| Loss of capability and lack of control over project sent outside | 12 | **55%** | 16 | 46% | 16 | 33% | 3.305 | 1 | 0.069 |
| Information leakage and lack of IPR protections | 08 | 36% | 18 | **51%** | 11 | 22% | 2.806 | 1 | 0.094 |
| Integration and diffusion risk and lack of inter-firm adaptation | 08 | 36% | 12 | 34% | 16 | 33% | 0.094 | 1 | 0.759 |
| Vendor financial instability and no relation specific investment | 10 | 45% | 07 | 20% | 19 | 39% | 0.002 | 1 | 0.964 |
| Poor project management and lack of co-management infrastructure | 05 | 23% | 13 | 37% | 12 | 24% | 0.031 | 1 | 0.860 |
| Problems stemming from organizational re-structuring | 06 | 27% | 10 | 29% | 11 | 22% | 0.287 | 1 | 0.592 |
| Poor leadership and lack of top executive support | 07 | 32% | 07 | 20% | 13 | 27% | 0.063 | 1 | 0.802 |
| Weak social capital and lack of social networking | **11** | **50%** | **07** | **20%** | **09** | **18%** | **6.413** | **1** | **0.011** |
| Client concentration and other client specific risks | 03 | 14% | 05 | 14% | 05 | 10% | 0.247 | 1 | 0.619 |

variations in the distribution of barriers among the three perspectives as shown in Table 9 for which p-value is less than 0.05. These barriers are:

*'Poor quality of service and lack of co-monitoring' and 'weak social capital and lack of social networking'.*

The percentage of 'poor quality of service and lack of co-monitoring' is very high (86%) in the 'client' group while it is low (55%) in 'Both' group'. According to Hagel and Brown [94] organizations have to consider taking advantage of outsourcing strategies, not only to utilize the cost advantages but also to benefit from the improved quality that offshore vendors provide. Today, 'quality production' is the top priority of clients for outsourcing. Most of the world's outsourcing projects go to India because India is the leading quality software provider [95]. 'Weak social capital and lack of social networking' *is only critical from the 'client' perspective.* According to Niazi *et al.* [62], informal networking can increase social bonds and ultimately increase trust of the client.

### G. BARRIERS IDENTIFIED VIA EMPIRICAL SURVEY (RQ7)

Barriers identified through our empirical study are shown in Table 10. The table has been divided into two main columns i.e. 'barriers' and ''Experts' Observation''. The 'barriers' column lists down all the challenges and the ''Experts' Observation'' column records experts' experiences about each barrier which are further divided into three columns i.e. 'Positive', 'Negative' and 'Neutral'. We would be remiss if we do not define 'negative impact' which is as follows: ''by a negative impact we mean the extent to which a certain barrier is perceived by practitioners to restrict the promotion of outsourcing partnership formation''. This is worth noting that out of 50 experts majority agree that all 26 barriers do have a negative impact on the outsourcing partnership formation. This is evident from the 'Positive' column where most of the values are above 70% except the few but none is below 58%. 'Poor quality of service and lack of co-monitoring' is the most agreed barrier in our study, i.e. 92%. We suggest that to compete in an international outsourcing market vendor(s) companies must improve the quality of their services

**TABLE 10.** Summary of the barriers from experts' perspective.

| Barriers | Experts' Observation (n=50) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Positive | | | | | Neutral | | Negative | | | | |
| | EA | MA | SA | X | %age | Y | %age | SDA | MDA | EDA | Z | %age |
| Vendor opportunism and low mutual trust | 8 | 15 | 17 | 40 | 80% | 4 | 8% | 3 | 2 | 1 | 6 | 12% |
| Communication gap and poor client-vendor coordination | 27 | 14 | 3 | 44 | 88% | 3 | 6% | 3 | 0 | 0 | 3 | 6% |
| Relational risk and poor relationship management | 27 | 15 | 1 | 43 | 86% | 4 | 8% | 3 | 0 | 0 | 3 | 6% |
| Vendor legacy technological infrastructure and lack of technical capability | 37 | 4 | 4 | 45 | 90% | 5 | 10% | 0 | 0 | 0 | 0 | 0% |
| Poor quality of service and lack of co-monitoring | 38 | 4 | 4 | 46 | 92% | 2 | 4% | 2 | 0 | 0 | 2 | 4% |
| Weak organizational proximity and work dispersion | 19 | 15 | 10 | 44 | 88% | 1 | 2% | 5 | 0 | 0 | 5 | 10% |
| Hidden cost and high anticipated switching cost | 15 | 14 | 10 | 39 | 78% | 2 | 4% | 6 | 2 | 1 | 9 | 18% |
| Poor contract management and enforcement | 22 | 17 | 2 | 41 | 82% | 4 | 8% | 5 | 0 | 0 | 5 | 10% |
| Poor knowledge sharing and cooperation between partner | 14 | 11 | 12 | 37 | 74% | 6 | 12% | 4 | 3 | 0 | 7 | 14% |
| Insufficient knowledge of the client activities and lack of domain training | 16 | 14 | 11 | 41 | 82% | 4 | 8% | 4 | 1 | 0 | 5 | 10% |
| Volatile requirement and no policy for change control | 18 | 10 | 8 | 36 | 72% | 6 | 12% | 7 | 1 | 0 | 8 | 16% |
| Strategic inflexibility and otiose dispute resolution mechanism | 6 | 15 | 15 | 36 | 72% | 5 | 10% | 6 | 2 | 1 | 9 | 18% |
| Poor estimation and lack of capacity to deliver product under strict time schedules | 16 | 14 | 13 | 43 | 86% | 4 | 8% | 3 | 0 | 0 | 3 | 6% |
| Geopolitical uncertainty and country instability | 23 | 13 | 6 | 42 | 84% | 4 | 8% | 4 | 0 | 0 | 4 | 8% |
| Misaligned goal, idiosyncratic objective and asymmetric power | 10 | 11 | 12 | 33 | 66% | 11 | 22% | 5 | 1 | 0 | 6 | 12% |
| Sign of uncertainty and lack of uncertainty absorption mechanism | 12 | 11 | 9 | 32 | 64% | 11 | 22% | 6 | 1 | 0 | 7 | 14% |
| Organization inertia and lack of human capital management expertise | 13 | 12 | 9 | 34 | 68% | 8 | 16% | 7 | 1 | 0 | 8 | 16% |
| Loss of capability and lack of control over project sent outside | 28 | 12 | 3 | 43 | 86% | 3 | 6% | 4 | 0 | 0 | 4 | 8% |
| Information leakage and lack of IPR protections | 19 | 16 | 7 | 42 | 84% | 4 | 8% | 4 | 0 | 0 | 4 | 8% |
| Integration and diffusion risk and lack of inter-firm adaptation | 10 | 14 | 10 | 34 | 68% | 8 | 16% | 8 | 0 | 0 | 8 | 16% |
| Vendor financial instability and no relation specific investment | 9 | 12 | 10 | 31 | 62% | 8 | 16% | 8 | 3 | 0 | 11 | 22% |
| Poor project management and lack of co-management infrastructure | 20 | 13 | 4 | 37 | 74% | 3 | 6% | 8 | 2 | 0 | 10 | 20% |
| Problems stemming from organizational re-structuring | 11 | 14 | 9 | 34 | 68% | 8 | 16% | 6 | 2 | 0 | 8 | 16% |
| Poor leadership and lack of top executive support | 9 | 16 | 10 | 35 | 70% | 8 | 16% | 7 | 0 | 0 | 7 | 14% |
| Weak social capital and lack of social networking | 3 | 13 | 13 | 29 | 58% | 17 | 34% | 4 | 0 | 0 | 4 | 8% |
| Client concentration and other client specific risks | 6 | 13 | 11 | 30 | 60% | 9 | 18% | 7 | 2 | 0 | 9 | 18% |

and process. Literature reveals that Indian software industry is the proven leader in high quality provision which makes India a dominant country in quality software production in the international market [96], [97].

### *H. ASSOCIATION BETWEEN VARIOUS BARRIERS AND SOP FORMATION (RQ8)*

In response to the RQ8, the responses of the participants are grouped into 3 groups X, Y, and Z, as shown in Table 11. Group *X* counts the frequency of the positive responses (slightly agree, moderately agree, and extremely agree), group Y counts the frequency of the neutral or not sure responses while group *Z* counts the frequency of the responses responded (extremely disagree, moderately disagree, and slightly disagree). To find the association between various inhibitors and SOP formation, we have listed 26 hypotheses (as listed in Appendix B). Since a questionnaire survey does not hold normality assumption, therefore Fisher exact test was used to test the hypothesis. Fisher exact test is a widely adopted non-parametric test for finding a significant association between variables. Table 11 shows the statistical results; it can be seen from Table 11, significance value for all the hypotheses are less than the threshold value (0.05) except the last one. Since, based on correlation (shown by Phi) for the entire listed hypothesis, the entire null hypothesis not holds except the last one. Therefore, we accept the entire alternate hypothesis except for the last one. Further, the positive responses in Table 10 show that the majority of the responded agreed that these barriers can inhibit the formation of SOP. ''Poor quality of service and lack of co-monitoring'' and ''vendor legacy technological infrastructure and lack of technical capability'' were the most cited barriers, with a value of 92% and 90%, respectively. This seems to align with our SLR study results.

For instance, the value of Phi is 0.90 for 'vendor legacy technological infrastructure and lack of technical capability' followed by 0.88 for 'poor quality of service and lack of co-monitoring'. Also, literature reveals that Indian software industry is the proven leader in high quality provision via the latest technology and best technical skills, which makes India a dominant country for quality software products in the international market [96]. The third most significant

**TABLE 11.** Statistics details of hypothesis testing.

| SNO | H1 | SOP | Value | Ext.sig | Phi | App.sig | Result |
|---|---|---|---|---|---|---|---|
| 1 | H1 | 87 | 46.54 | 0.000 | +0.68 | 0.000 | ✓ |
| 2 | H2 | 81 | 67.48 | 0.000 | +0.82 | 0.000 | ✓ |
| 3 | H3 | 78 | 64.41 | 0.000 | +0.80 | 0.000 | ✓ |
| 4 | H4 | 77 | 81.82 | 0.000 | +0.90 | 0.000 | ✓ |
| 5 | H5 | 75 | 77.56 | 0.000 | +0.88 | 0.000 | ✓ |
| 6 | H6 | 73 | 60.86 | 0.000 | +0.78 | 0.000 | ✓ |
| 7 | H7 | 68 | 36.06 | 0.000 | +0.60 | 0.000 | ✓ |
| 8 | H8 | 64 | 52.17 | 0.000 | +0.72 | 0.000 | ✓ |
| 9 | H9 | 62 | 36.53 | 0.000 | +0.60 | 0.000 | ✓ |
| 10 | H10 | 62 | 52.17 | 0.000 | +0.72 | 0.000 | ✓ |
| 11 | H11 | 52 | 31.82 | 0.000 | +0.56 | 0.000 | ✓ |
| 12 | H12 | 51 | 29.45 | 0.000 | +0.54 | 0.000 | ✓ |
| 13 | H13 | 46 | 64.41 | 0.000 | +0.80 | 0.000 | ✓ |
| 14 | H14 | 45 | 58.13 | 0.000 | +0.76 | 0.000 | ✓ |
| 15 | H15 | 45 | 30.64 | 0.000 | +0.55 | 0.000 | ✓ |
| 16 | H16 | 46 | 26.27 | 0.000 | +0.51 | 0.000 | ✓ |
| 17 | H17 | 44 | 27.75 | 0.000 | +0.53 | 0.000 | ✓ |
| 18 | H18 | 44 | 61.06 | 0.000 | +0.78 | 0.000 | ✓ |
| 19 | H19 | 37 | 58.13 | 0.000 | +0.76 | 0.000 | ✓ |
| 20 | H20 | 36 | 27.75 | 0.000 | +0.53 | 0.000 | ✓ |
| 21 | H21 | 36 | 16.42 | 0.000 | +0.41 | 0.000 | ✓ |
| 22 | H22 | 30 | 29.27 | 0.000 | +0.54 | 0.000 | ✓ |
| 23 | H23 | 27 | 27.75 | 0.000 | +0.53 | 0.000 | ✓ |
| 24 | H24 | 27 | 32.18 | 0.000 | +0.54 | 0.000 | ✓ |
| 25 | H25 | 27 | 28.27 | 0.000 | +0.53 | 0.000 | ✓ |
| 26 | H26 | 13 | 0.040 | 0.499 | +0.02 | 0.999 | ***X*** |

correlation is observed for 'communication gap and poor client-vendor coordination (0.82), followed by 'relational risk and poor relationship management' and 'poor estimation and lack of capacity to deliver product under strict time schedules (0.80)'. Communication gap not only consequences in misapprehensions and lack of control over the project but also decreases trust and increases chances of opportunism [98], [99]. Abdullah and Verner [31], suggest that OSD arrangement should be made successful by avoiding relational risks like the debasement of service performance and quality mishaps. Relational risk can be tackled by better management of the ongoing relationship [72]. Relationship management has a strong role in the success of software outsourcing projects [73].

The barriers 'weak organizational proximity and work dispersion' and 'sign of uncertainty and lack of uncertainty absorption mechanism' shows an association of 0.78, which necessitates the tools and techniques for increasing proximity by reducing organizational differences. Khan and Azeem [76], consider cultural differences as a critical challenge to offshore outsourcing. According to Mukherjee*et al.* [73], offshoring gives birth to new challenges such as organizational differences and the language and cultural differences between client and vendor.

'Poor estimation and lack of capacity to deliver product under strict time schedules' and 'poor project management and lack of co-management infrastructure' have Ø 0.76.

Followed by 'hidden cost and high anticipated switching cost' and 'poor knowledge sharing management and cooperation between partners shows a correlation of 0.72. Except 'weak social capital and lack of social networking' and 'client concentration' all barriers have Ø > 0.50.

## VI. SUMMARY AND DISCUSSION

We have identified 26 barriers for SOP stakeholders in total through SLR study. These barriers will influence clients in the conversion of the conventional SDO process to SOP with their vendors. Our research aims to provide SOP vendors with clear guidance that can support them to design and implement effective outsourcing partnership ventures. This paper recommends that vendors should focus on all of the reported barriers as mentioned in Table 3. Barriers signify some of the critical areas where management should focus their attention to better design SOP initiatives. To decide criticality of barriers, the below-mentioned criterion will be used:

If a barrier is quoted in the SLR sample with >=50% then that barrier will be considered as a critical barrier (CB) in this exploratory SLR study. The same criterion was also incorporated in our previous study [92], [100]–[104]. A study was conducted by Niazi *et al.* [62], in which they have enlisted key factors in software process improvement (SPI) with the criterion >=50%. According to them, if a factor is reported in the literature with >=50%, then that factor should be considered critical in SPI efforts. A comparable criterion has also been used by some other researchers [54], [76], [83]. However, SDO practitioners and researchers may also delineate their own criterion to plump the criticality of the identified SFs.

To answer RQ1 considering the aforementioned criterion, the first ten barriers are considered critical barriers as listed in Table 3. These CBs play a negative role in the conversion of existing outsourcing relationship to a partnership.

For RQ2, using the criterion of criticality, we found eleven barriers critical in both decades as shown in Table 12. We did not find any barriers, which are critical in the first decade (2001-2009) and not critical in the second decade (2010-2018). To see the changed in a short time slot, we further divide the two decades into four periods. Twelve common critical barriers are presented in Table 13. Out of these 12 common CBs, eight are commonly critical in all four periods. Two barriers 'weak organizational proximity and work dispersion' (17%, 64%, 73%, and 76%) and 'volatile requirement and no policy for change control' (33%, 50%, 51%, and 56%) remains critical in all four periods except the first one from 2001 to 2004. Further, barrier 'poor knowledge sharing management and cooperation between partner (67%, 45%, 65%, and 59%) is critical in all except the second period. While 'strategic inflexibility and otiose dispute resolution mechanism' (17%, 50%, 54%, 46%) is found critical only in the middle two periods from 2005 to 2013.

We found significant differences '*information leakage and lack of IPR protections*' and '*client concentration* across

**TABLE 12.** Summary of the common barriers in the two decades.

| Critical barriers | Decade One 2001-2009 (N=33) | Decade Two 2010-2018 (N=73) |
|---|---|---|
| Vendor opportunism and low mutual trust | 85% | 81% |
| Communication gap and poor client-vendor coordination | 70% | 79% |
| Relational risk and poor relationship management | 76% | 73% |
| Vendor legacy technological infrastructure and lack of technical capability | 70% | 74% |
| Poor quality of service and lack of co-monitoring | 76% | 68% |
| Weak organizational proximity and work dispersion | 55% | 75% |
| Hidden cost and high anticipated switching cost | 61% | 66% |
| Poor contract management and enforcement | 61% | 60% |
| Poor knowledge sharing management and cooperation between partner | 52% | 62% |
| Insufficient knowledge of the client activities and lack of domain training | 52% | 62% |
| Volatile requirement and no policy for change control | 52% | 52% |

**TABLE 13.** Summary of the common barriers in the four periods.

| Critical barriers | Period One 2001-2004 (N=06) | Period Two 2005-2008 (N=22) | Period Three 2009-2013 (N=37) | Period four 2014-2018 (N=41) |
|---|---|---|---|---|
| Vendor opportunism and low mutual trust | 67% | 91% | 76% | 85% |
| Communication gap and poor client-vendor coordination | 50% | 73% | 76% | 80% |
| Relational risk and poor relationship management | 83% | 77% | 68% | 76% |
| Vendor legacy technological infrastructure and lack of technical capability | 83% | 64% | 78% | 71% |
| Poor quality of service and lack of co-monitoring | 83% | 77% | 57% | 78% |
| Hidden cost and high anticipated switching cost | 67% | 59% | 68% | 63% |
| Poor contract management and enforcement | 50% | 59% | 65% | 59% |
| Insufficient knowledge of the client activities and lack of domain training | 50% | 50% | 65% | 59% |
| Weak organizational proximity and work dispersion | (17%) | 64% | 73% | 76% |
| Poor knowledge sharing management and cooperation between partner | 67% | (45%) | 65% | 59% |
| Volatile requirement and no policy for change control | (33%) | 50% | 51% | 56% |
| Strategic inflexibility and otiose dispute resolution mechanism | (17%) | 50% | 54% | (46%) |

the four periods. The reason might be that 'data leakage and lack of IPR protection is mostly related to offshoring and offshoring got momentum in the recent past that is why its popularity increases over time. Mukherjee *et al.* [73], advise that client must take into account intellectual property regulations in offshore outsourcing arrangements. According to them, it is very surprising that the most well-known offshoring destinations like China, India, Philippines, and Russia have maladroit legal systems and poor IPR protection. Client concentration, bigger size of the client, engaging with many clients is a new factor and only mentioned in the last two periods only. We did not find any study for comparison in connection to timeline analysis for 'client concentration'.

To answer RQ3, comparison of the barriers in the three company sizes categories is performed; we come across similarities greater than differences. The results in Table 14 confirm that eight barriers are critical across all the company size categories.

*Two barriers 'communication gap and poor client-vendor coordination' and 'poor knowledge sharing management and cooperation between partners' are' critical to all, except the small organization*.

Small clients outsource small projects only which last in the small spell. They have a tendency to generalization rather than specialization. Further, they have greatly central structures with the chief executive officers (CEOs) making most of the critical decisions [37]. Additionally, the projects of small companies are not information critical [37].

*'Volatile requirement and no policy for change control'* is critical to medium and large only. The rest of the 14 barriers are not critical in none of the company size category as shown in Table 5.

**TABLE 14.** Summary of the common barriers in the company size.

| Critical barriers | Small (07) | Medium (N=18) | Large (N=50) | Mixed (N=22) |
|---|---|---|---|---|
| Vendor opportunism and low mutual trust | 57% | 83% | 83% | 86% |
| Communication gap and poor client-vendor coordination | **(43%)** | 83% | 80% | 68% |
| Relational risk and poor relationship management | 71% | 67% | 76% | 73% |
| Vendor legacy technological infrastructure and lack of technical capability | 71% | 61% | 73% | 82% |
| Poor quality of service and lack of co-monitoring | 71% | 61% | 75% | 68% |
| Weak organizational proximity and work dispersion | 57% | 56% | 73% | 73% |
| Hidden cost and high anticipated switching cost | 57% | 67% | 61% | 73% |
| Poor contract management and enforcement | 71% | 56% | 64% | 50% |
| Poor knowledge sharing management and cooperation between partner | **(29%)** | 50% | 63% | 64% |
| Insufficient knowledge of the client activities and lack of domain training | 71% | 72% | 56% | 50% |
| Volatile requirement and no policy for change control | 43% | 56% | 54% | **(45%)** |

**TABLE 15.** Summary of the common barriers in the three continents.

| Critical barriers | Asia (N=32) | Europe (N=31) | America (N=19) | Mixed (N=24) |
|---|---|---|---|---|
| Vendor opportunism and low mutual trust | 91% | 84% | 68% | 79% |
| Communication gap and poor client-vendor coordination | 88% | 77% | 53% | 79% |
| Relational risk and poor relationship management | 84% | 71% | 74% | 63% |
| Vendor legacy technological infrastructure and lack of technical capability | 72% | 74% | 63% | 79% |
| Poor quality of service and lack of co-monitoring | 75% | 74% | 68% | 63% |
| Weak organizational proximity and work dispersion | 81% | 74% | 53% | 58% |
| Hidden cost and high anticipated switching cost | 59% | 68% | 58% | 71% |
| Poor contract management and enforcement | 59% | 65% | 58% | 58% |
| Poor knowledge sharing management and cooperation between partner | 75% | 52% | **(47%)** | 54% |
| Insufficient knowledge of the client activities and lack of domain training | 63% | 55% | **(47%)** | 67% |
| Requirement management issues | 50% | 61% | **(37%)** | 54% |
| Strategic inflexibility and otiose dispute resolution mechanism | 59% | **(39%)** | 53% | **(42%)** |
| Poor estimation and lack of capacity to deliver product under strict time schedules | 53% | **(35%)** | **(42%)** | **(42%)** |
| Geopolitical risk and country instability | 50% | **(39%)** | **(32%)** | **(46%)** |
| Misaligned goal, idiosyncratic objective and asymmetric power | 50% | **(45%)** | **(32%)** | **(38%)** |
| Sign of uncertainty and lack of uncertainty absorption mechanism | **(41%)** | **(29%)** | 68% | **(46%)** |

To answer RQ4, we compare barriers in various continents using the above mentioned criterion. Comparison of the barriers identified in the four continents categories indicates that there are more similarities than differences between the barriers distribution. The results confirm that eight barriers are critical across all the continent categories as shown in Table 15. *'Poor knowledge sharing management and cooperation between partner', 'insufficient knowledge of the client activities and lack of domain training', 'requirement management issues' are critical in all expect 'America'.*

Ali *et al.* [105], conducted a study on KSM risks in outsourcing from various continents perspective. They mention KSM risk in 'America' by a sample of just 2%; this confirms not criticality of KSM in America. According to Teo and Bhattacherjee [81], most of the outsourcing literature focuses on knowledge transfer from client to the vendor while very limited focus on knowledge transfer from vendor to the client. In the first poor KSM is a risk for the client while in the second KSM is a headache for the vendor. In view of Teo and Bhattacherjee [81], software development projects require significant investments in knowledge gaining and distribution such as giving domain specific training to vendor staff in order to be aware of the client's corporate trade and maneuver. Such investments may have no or very little value in case of contract termination in the short run. Usually, a client gives training to the vendor in order to

**TABLE 16.** Summary of the common barriers in the analysis perspective.

| Critical barriers | Academic (N=38) | Industry (N=68) |
|---|---|---|
| Vendor opportunism and low mutual trust | 82% | 82% |
| Communication gap and poor client-vendor coordination | 76% | 76% |
| Relational risk and poor relationship management | 82% | 69% |
| Vendor legacy technological infrastructure and lack of technical capability | 68% | 75% |
| Poor quality of service and lack of co-monitoring | 74% | 69% |
| Weak organizational proximity and work dispersion | 66% | 71% |
| Hidden cost and high anticipated switching cost | 66% | 63% |
| Poor contract management and enforcement | 66% | 57% |
| Poor knowledge sharing management and cooperation between partner | 58% | 59% |
| Insufficient knowledge of the client activities and lack of domain training | 55% | 60% |
| Requirement management issues | **(42%)** | 57% |
| Sign of uncertainty and lack of uncertainty absorption mechanism | 53% | 38% |

pass functional business knowledge and to increase cultural understanding.

Lahiri and Kedia [106], reports a vendor to become global sourcing partner with American client they must have experience of controlling similar business procedures and functional knowledge of client's business. Additionally, they must possess a good track record of prosperous process execution, transition, and management through different geographic locations, time-zones, and in different languages. Because today the US clients need a partner who executes business processes on behalf of them.

*'Poor estimation and lack of capacity to deliver product under strict time schedules, 'geopolitical risk and country instability' and 'misaligned goal, idiosyncratic objective and asymmetric power' are critical in 'Asia' only.*

These are the barriers mostly related to vendors and the greatest number of vendors belongs to 'Asia'. That might be the reason that these are highlighted more in 'Asia' as compared to 'Europe' and 'America'. According to Sangaiah and Thangavelu [95], 65% of all CMMI level-5 firms are established in India [95]. Most of the offshore partnership is formed between the US and India [56]. 'Geopolitical risk' includes uncertainty about government policies to offshoring and different legal systems, rules, and regulations in global trading. It may also include country instability such as political instability, corruption, and terrorist threats. This risk arises when outsourcing is practice across the border in offshore scenarios. Mukherjee *et al.* [73], reports offshoring gives birth to this unique challenge due to geographic distance and political conditions of the vendor location.

*'Strategic inflexibility and otiose dispute resolution mechanism' is critical in 'Asia' and 'America' but not in 'Europe'.*

The reason might be that this barrier is mostly related to an offshore scenario in a diverse culture. Since client companies from Western Europe often prefer eastern European countries to China, India, Philippines, or Russia as offshore destinations because of their symmetric culture and time zone advantages [73]. Moreover, European clients prefer nearshoring over offshoring [56].

*'Sign of uncertainty and lack of uncertainty absorption mechanism' is critical in 'America' Only.*

American projects are very critical, that is why they are more concerned about goals and objectives as well as uncertainty like availability of human resources for a project. The scarcity of appropriate talent in the American market and huge constraints on foreign talent acquisition has also promoted offshoring of work to locations with greater talent base [73].

Using the criterion of criticality for RQ5, we found ten barriers critical from both perspectives as shown in Table 16.

*'Sign of uncertainty and lack of uncertainty absorption mechanism' in the 'Academia' but not in the 'Industry'.*

The reason might be that from an academic perspective the barriers are critical but from the industrial perspective, it is controlled risk and not critical.

*We found one such barrier, is 'Industry' but not in the 'Academia' while i.e. 'requirement management issues'.*

Due to the lack of studies on perspective, the reason in this section cannot be verified in the literature. We plan to conduct an industrial study and then compare the results of both perspectives.

In response to RQ6, we distribute the CBs into the Client-Vendor perspective. We found all the ten CBs in Table 3 also as common CBs to both client and vendor.

Four barriers that are critical to clients only are:

1. Strategic inflexibility and otiose dispute resolution mechanism
2. Sign of uncertainty and lack of uncertainty absorption mechanism
3. High staff turnover and lack of human capital management expertise and
4. Lack of control over the project

**TABLE 17.** Reference traceability table.

| Article | Barriers | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 | B17 | B18 | B19 | B20 | B21 | B22 | B23 | B24 | B25 | B26 |
| M1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| M2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M3 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| M4 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| M5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| M7 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| M8 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| M9 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| M10 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| M11 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| M12 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| M13 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M14 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M15 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| M16 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| M17 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| M18 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| M19 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M20 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| M21 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| M22 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M23 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| M24 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| M25 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M26 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| M27 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| M28 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| M29 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| M30 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| M31 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| M32 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| M33 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| M34 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| M35 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| M36 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| M37 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| M38 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| M39 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| M40 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M41 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| M42 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M43 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M44 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| M45 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| M46 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M47 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| M48 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| M49 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| M50 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| M51 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| M52 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| M53 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| M54 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| M55 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| M56 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| M57 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| M58 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M59 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| M60 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| M61 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| M62 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| M63 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

**TABLE 17.** *(Continued.)* **Reference traceability table.**

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M64 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| M65 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| M66 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| M67 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| M68 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| M69 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M70 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| M71 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| M72 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M73 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| M74 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M75 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| M76 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| M77 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M78 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M79 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M80 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| M81 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| M82 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| M83 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M84 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| M85 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| M86 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M87 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| M88 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| M89 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 |
| M90 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M91 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| M92 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M93 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| M94 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| M95 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| M96 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| M97 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| M98 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 |
| M99 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| M100 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| M101 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M102 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| M103 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| M104 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| M105 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| M106 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |

Five barriers that are critical to vendors only are:

1. Requirement management issues
2. Poor estimation and lack of capacity to deliver product under strict time schedules
3. Geopolitical risk and country instability
4. Misaligned goals, idiosyncratic objectives, and asymmetric power
5. Information leakage and lack of IPR protection

The remaining seven barriers are common to none of them are

1. Integration and diffusion risk and lack of inter-firm adaptation
2. Vendor financial instability and no relation specific investment
3. Lack of co-management infrastructure and vendor poor project management capabilities
4. Problems stemming from organizational restructuring
5. Poor leadership and lack of top executive support
6. Weak social capital and lack of social networking
7. Client concentration and other client specific risks

In connection to RQ7, we have identified the five critical barriers based on the *extremely agree* column frequency in Table 10.

1. Poor quality of service and lack of co-monitoring– 76%
2. Poor infrastructure – 76% and
3. Insufficient quality of technical capability– 74%
4. Communication gap and poor client-vendor coordination – 54%
5. Relational risk and poor relationship management – 54%.

However, other barriers with percentage, >=30 (extremely agree) are also important to be addressed to win an outsourcing partner position in future projects. These challenges are 'poor project management and lack of co-management infrastructure' (56%), 'geopolitical risk and country instability' (48%), 'lack of psychological and poor contract

**TABLE 18.** Hypothesis for association between 26 barriers and SOP formation.

| SNO | Hypothesis |
|---|---|
| $H_1$ | $H_O$: There is no relationship between 'vendor opportunism and lack of trust' and SOP formation.<br>$H_a$ : There is some relationship between 'vendor opportunism and lack of trust' and SOP formation |
| $H_2$ | $H_O$: There is no relationship between 'communication gap and poor client-vendor coordination' and SOP formation<br>$H_a$ : There is some relationship between 'communication gap and poor client-vendor coordination' and SOP formation |
| $H_3$ | $H_O$: There is no relationship between 'relational risk and poor relationship management' and SOP formation<br>$H_a$ : There is some relationship between 'relational risk and poor relationship management' and SOP formation |
| $H_4$ | $H_O$: There is no relationship between 'lack of technical capability' and SOP formation<br>$H_a$ : There is some relationship between 'lack of technical capability and 'poor infrastructure' and SOP formation |
| $H_5$ | $H_O$: There is no relationship between 'poor quality of service and lack of co-monitoring' and SOP formation<br>$H_a$ : There is some relationship between 'poor quality of service and lack of co-monitoring' and SOP formation |
| $H_6$ | $H_O$: There is no relationship between 'organizational differences' and SOP formation<br>$H_a$ : There is some relationship between 'organizational differences' and SOP formation |
| $H_7$ | $H_O$: There is no relationship between 'hidden cost and high anticipated switching' and SOP formation<br>$H_a$ : There is some relationship between 'hidden cost and high anticipated switching' and SOP formation |
| $H_8$ | $H_O$: There is no relationship between 'poor contract management' and SOP formation<br>$H_a$ : There is some relationship between 'poor contract management' and SOP formation |
| $H_9$ | $H_O$: There is no relationship between 'poor knowledge sharing management' and SOP formation<br>$H_a$ : There is no relationship between 'poor knowledge sharing management 'and SOP formation |
| $H_{10}$ | $H_O$: There is no relationship between 'insufficient knowledge of the client activities and lack of training' and SOP formation<br>$H_a$ : There is some relationship between 'insufficient knowledge of the client activities and lack of training' and SOP formation |
| $H_{11}$ | $H_O$: There is no relationship between 'volatile requirement and poor requirement change control' and SOP formation<br>$H_a$ : There is no relationship between 'volatile requirement and poor requirement change control' and SOP formation |
| $H_{12}$ | $H_O$: There is no relationship between 'strategic inflexibility and otiose dispute resolution mechanism' and SOP formation<br>$H_a$ : There is no relationship between 'strategic inflexibility and otiose dispute resolution mechanism' and SOP formation |
| $H_{13}$ | $H_O$: There is no relationship between 'poor estimation and delays' and SOP formation<br>$H_a$ : There is some relationship between 'poor estimation and delays' and SOP formation |
| $H_{14}$ | $H_O$: There is no relationship between 'geopolitical risk and country instability' and SOP formation<br>$H_a$ : There is some relationship between 'geopolitical risk and country instability' and SOP formation |
| $H_{15}$ | $H_O$: There is no relationship between 'misaligned goal, and power difference' and SOP formation<br>$H_a$ : There is some relationship between 'misaligned goal, and power difference' and SOP formation |
| $H_{16}$ | $H_O$: There is no relationship between 'project uncertainty and lack of uncertainty absorption mechanism' and SOP formation<br>$H_a$ : There is some relationship between 'project uncertainty and lack of uncertainty absorption mechanism' and SOP formation |
| $H_{17}$ | $H_O$: There is no relationship between 'high staff turnover and lack of HRM expertise' and SOP formation<br>$H_a$ : There is some relationship between 'high staff turnover and lack of HRM expertise' and SOP formation |
| $H_{18}$ | $H_O$: There is no relationship between 'poor project management and lack of co-management infrastructure' and SOP formation<br>$H_a$ : There is some relationship between 'poor project management and lack of co-management' and SOP formation |
| $H_{19}$ | $H_O$: There is no relationship between Information leakage and lack of intellectual property right protection and SOP formation<br>$H_a$ : There is no relationship between Information leakage and lack of intellectual property right protection and SOP formation |
| $H_{20}$ | $H_O$: There is no relationship between Incompatibility and lack of inter-firm adaptation and SOP formation<br>$H_a$ : There is no relationship between Incompatibility and lack of inter-firm adaptation and SOP formation |
| $H_{21}$ | $H_O$: There is no relationship between 'vendor financial instability and no relation specific investment' and SOP formation<br>$H_a$ : There is some relationship between 'vendor financial instability and no relation specific investment' and SOP formation |
| $H_{22}$ | $H_O$: There is no relationship between 'lack of control over project' and SOP formation<br>$H_a$ : There is some relationship between 'lack of control over project' and SOP formation |
| $H_{23}$ | $H_O$: There is no relationship between 'problems stemming from organizational re-structuring' and SOP formation<br>$H_a$ : There is some relationship between 'problems stemming from organizational re-structuring' and SOP formation |
| $H_{24}$ | $H_O$: There is no relationship between 'poor leadership and lack of top executive support' and SOP formation<br>$H_a$ : There is some relationship between 'poor leadership and lack of top executive support' and SOP formation |
| $H_{25}$ | $H_O$: There is no relationship between 'weak social capital and lack of social networking' and SOP formation<br>$H_a$ : There is some relationship between 'weak social capital and lack of social networking' and SOP formation |
| $H_{26}$ | $H_O$: There is no relationship between 'client concentration and other client specific risks' and SOP formation<br>$H_a$ : There is no relationship between 'client concentration and other client specific risks' and SOP formation |

management' (44%), and 'lack of control over project' (40%), 'poor knowledge sharing management and cooperation between partner' (38%), 'information leakage and lack of IPR protections' (38%), 'volatile requirement and poor requirement change control' (36%), 'insufficient knowledge of the client activities and lack of domain training' (32%),'poor estimation and lack of capacity to deliver product under strict time schedules' (32%) and 'Hidden cost and high anticipated switching' (30%). These findings confirm and validate the results of our systematic literature review.

To answer RQ8, we the association of 25 barriers with SOP formation is found statistically significant with effect size ($0.41 < Ø < 0.90$, $P < 0.05$) except the last one.

## VII. STUDY LIMITATION

In this section, the threats of validity concerning the SLR study have been discussed. By using SLR procedure, we mined data about barriers in SOP, but how valid are our findings? Related to internal validity the ever first threat to be, for any particular study, they have not been explicitly mentioned the cause to report SOP barriers. We are unable to independently control this threat. Regarding the threat to external validity? Our sample size is composed of articles from diverse continents from many countries. We have full confidence in our results because, we found similarities greater than differences in our outcomes and the results concluded by other researchers such as [107], [95], [62], this provides

**TABLE 19.** Criticality table based on five study variables different variables.

| Code | Critical in CONTINENTS | Critical in COMPANIES | Critical in DECADES | Critical from Location PERSPECTIVE | Critical from PERSPECTIVE |
|---|---|---|---|---|---|
| B1 | All | All | Both | Both | Both |
| B2 | All | All | Both | Both | Both |
| B3 | All | All | Both | Both | Both |
| B4 | All | All | Both | Both | Both |
| B5 | All | All | Both | Both | Both |
| B6 | All | All | Both | Both | Both |
| B7 | All | All | Both | Both | Both |
| B8 | All | All | Both | Both | Both |
| B9 | All except 'AMERICA' | All except 'SME' | Both | Both | Both |
| B10 | All except 'AMERICA' | All | Both | Both | Both |
| B11 | All except 'AMERICA' | All | Both | 'INDUSTRY' Only | Vendor Only |
| B12 | 'ASIA' and 'AMERICA' | 'MIXED' Only | None of them | None of them | Client Only |
| B13 | 'ASIA' Only | None of them | None of them | None of them | Vendor Only |
| B14 | 'ASIA' Only | None of them | None of them | None of them | Vendor Only |
| B15 | 'ASIA' Only | None of them | None of them | None of them | Vendor Only |
| B16 | 'AMERICA' Only | None of them | None of them | 'ACADEMIC' Only | Client Only |
| B17 | None of them | None of them | None of them | None of them | Client Only |
| B18 | None of them | None of them | None of them | None of them | Client Only |
| B19 | None of them | None of them | None of them | None of them | Vendor Only |
| B20 | 'MIXED' Only | None of them | None of them | None of them | None of them |
| B21 | None of them | None of them | None of them | None of them | None of them |
| B22 | None of them | None of them | None of them | None of them | None of them |
| B23 | None of them | None of them | None of them | None of them | None of them |
| B24 | None of them | None of them | None of them | None of them | None of them |
| B25 | None of them | None of them | None of them | None of them | None of them |
| B26 | None of them | None of them | None of them | None of them | None of them |

evidence for generalization. We have conducted our SLR in teamwork and consulted the software engineering research group (SERG_UOM) for validation of the search string and SLR protocol. To deal with subjectivity and researcher biases, we have also done inter-rater reliability checks in every step of the SLR conduction.

We do not claim that we have included all digital libraries, so executing our SLR process; it is possible to miss some relevant paper. The first reason is abundant papers on partnership and outsourcing. And the second reason is inaccessibility of every digital library because of limited resources. However, the included digital libraries are sufficient for the synthesis of results in our study. According to other academics investigator like [2], [47], [49], [59], [62], [76] using SLR as a method for data collection, this is not a methodical faux pas.

The empirical study part of this research engaged participants mainly from the Asian countries only. This is because this research project was conducted and sponsored in the context of Asia. However, to lessen population prejudice, contributors from other countries such as North America were also invited to include diverse perspectives. Fifty experts voluntarily partook in this exploratory study and there was no previous bond between the participants and researchers. Contributors were informed that their participation is entirely voluntary and they can withdraw at any time any stage they want. However, to ensure external validity and to diminish any possible bias, the 50 contributors were chosen from 20 different countries. Besides, most of the participants had worked in a range of small, medium, and large multinational organizations. Moreover, the participant had worked on diverse outsourcing projects from onshore to nearshore and from nearshore to offshore. Although, we cannot claim that all the contributors from these 20 countries would agree with us, however, we believe that they provide a descriptive sample. In empirical survey-based research, it is hard or impossible to obtain a fully representative sample and to deal with them in an entirely objective fashion [108]. To overcome these limitations, only those participants were included who are involved in outsourcing. The claim of the participant was verified through some open-ended question that was difficult to answer by an ordinary developer or manager etc. This situation might create difficulties when contributors' judgments may be inaccurate or when outsourcing barrier supposed as significant for renewal or up gradation may not be significant at all. However, similar other to others opinion based empirical research studies [1], [34], [54], [109]–[111],

**TABLE 20.** Background of the survey participants.

| Respondent ID | Position in the company | Classification | Respondent Job Location | Experience in years | Classification | Company Scope | Company Size |
|---|---|---|---|---|---|---|---|
| #1 | Chief Executive Officer | Decision Maker | India | 11+ years | Senior | Multinational | Large |
| #2 | Chief Executive Officer | Decision Maker | Ireland | 7 years | Intermediate | Multinational | Medium |
| #3 | Senior System Analyst | Decision Maker | Pakistan | 11+ years | Senior | Multinational | Large |
| #4 | Project Coordinator | Manager | China | 8 years | Intermediate | Both | Medium |
| #5 | Professor | Academic Researcher | Pakistan | 11+ years | Senior | National | Large |
| #6 | Software Engineer | Developer | China | 2 years | Junior | Multinational | Large |
| #7 | Software Developer | Developer | Malaysia | 4 years | Junior | Both | Medium |
| #8 | Professor | Academic Researcher | Indonesia | 12.8 years | Senior | National | Large |
| #9 | Negotiator | Decision Maker | China | 7 years | Intermediate | Multinational | Large |
| #10 | Application Developer | Developer | China | 2 year | Junior | Multinational | Large |
| #11 | Technical Manager | Manager | China | 12 years | Senior | National | Medium |
| #12 | Programmer | Developer | Pakistan | 8 years | Intermediate | National | Medium |
| #13 | Senior Analyst | Decision Maker | China | 5+ years | Intermediate | National | Small |
| #14 | Technical Lead | Decision Maker | China | 12 years | Senior | Multinational | Medium |
| #15 | Web Developer | Developer | Pakistan | 3 years | Junior | Multinational | Small |
| #16 | Senior Outsourcing Manager | Decision Maker | Canada | 5+ years | Intermediate | Multinational | Medium |
| #17 | Senior Analyst | Decision Maker | India | 11+ years | Senior | Multinational | Large |
| #18 | Senior Contract Manager | Decision Maker | Phosphine | 5+ years | Intermediate | Multinational | Large |
| #19 | Senior System Analyst | Decision Maker | China | 3 years | Junior | Multinational | Large |
| #20 | Application Developer | Developer | China | 1.2 years | Junior | National | Small |
| #21 | Software Engineer | Developer | UK | 7 years | Intermediate | National | Small |
| #22 | IT Manager | Manager | China | 13 year | Senior | Multinational | Large |
| #23 | Requirement Manager | Manager | Pakistan | 7 years | Intermediate | Multinational | Medium |
| #24 | Development Manager | Manager | China | 4 years | Junior | National | Medium |
| #25 | Assistant Professor | Academic Researcher | Pakistan | 7 years | Intermediate | National | Large |
| #26 | System Manager | Manager | Pakistan | 2 year | Junior | National | Medium |
| #27 | Senior Software Engineer | Decision Maker | China | 5+ years | Intermediate | Multinational | Large |
| #28 | Project Coordinator | Manager | China | 5+ years | Intermediate | Multinational | Medium |
| #29 | Development Manager | Manager | USA | 1.6 years | Junior | National | Medium |
| #30 | IT Manager | Manager | Nigeria | 4.6 years | Junior | National | Medium |
| #31 | Quality assurance Manager | Manager | India | 8 years | Intermediate | Multinational | Large |
| #32 | Project Manager | Manager | Pakistan | 1 year | Junior | National | Small |
| #33 | Full Stack Developer | Developer | China | 2 years | Junior | National | Small |
| #34 | Project Manager | Manager | China | 11+ years | Senior | Both | Medium |

**TABLE 20.** ***(Continued.)*** **Background of the survey participants.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| #35 | President | Decision Maker | China | 22 years | Senior | Multinational | Medium |
| #36 | Chief Executive Officer | Decision Maker | Pakistan | 20 years | Senior | Multinational | Large |
| #37 | Senior Manager | Decision Maker | Saudi Arabia | 7+ years | Intermediate | Multinational | Large |
| #38 | Outsourcing Analyst | Decision Maker | Saudi Arabia | 3 years | Junior | Multinational | Large |
| #39 | PhD. Student | Academic Researcher | Saudi Arabia | 4 years | Junior | National | Large |
| #40 | Senior Outsourcing Manager | Decision Maker | Finland | 11 years | Senior | National | Small |
| #41 | Junior Manager | Manager | Yemen | 1 years | Junior | National | Small |
| #42 | Project Manager | Manager | Jordan | 4 years | Junior | National | Small |
| #43 | Project Coordinator Manager | Manager | Jordan | 7 years | Intermediate | Multinational | Large |
| #44 | Software Designer | Developer | Haiti | 4 years | Junior | National | Small |
| #45 | Test Case Manger | Manager | Australia | 5+ years | Intermediate | National | Large |
| #46 | Project Coordinator | Manager | Korea | 14 years | Senior | Multinational | Large |
| #47 | Distributed Team Leader | Manager | Russia | 12 years | Senior | Multinational | Medium |
| #48 | Project Coordinator | Manager | Japan | 10 years | Intermediate | National | Medium |
| #49 | Test Manager | Manager | Malaysia | 9+ years | Intermediate | Multinational | Large |
| #50 | Chief Executive Officer | Decision Maker | Malaysia | 11+ years | Senior | Multinational | Large |

we have full confidence that the findings of this research are based on the data that have been collected from the relevant participants who have been involved and have vastly diversified experience in SDO.

## VIII. CONCLUSION AND FUTURE WORK

Based on the work conducted in this article, we suggest that client-vendor relation needs to move beyond that of a contractual arrangement into more beneficial, trusted, and a collaborative form called partnership. Basing on the interrelated literature twenty-six barriers are identified. Out of 26 barriers, 10 barriers are considered critical (CBs), by qualifying the predefined criterion. The identified SOP barriers are associated based on different variables such as 'continents', 'company size., 'decades', 'location of analysis' and, 'client-vendor perspective'. We suggest that vendors involved in outsourcing relationships should emphasize on all the barriers especially the CBs (most cited barriers in Table 3), in order to influence clients in converting their existing conventional outsourcing relationship into outsourcing partnerships. For barriers in different decades, the vendor should refer to Table 4 (RQ2). For barriers in small, medium, and large companies, they must consult Table 5 (RQ3). Vendors engaged in the cross-continents must focus on the mentioned frequencies of each factor in Table 6 (RQ4). If vendors want to know barriers with respect to the perspective of analysis, they must follow the findings in Table 7 (RQ5). For barriers from the client-vendor perspective, they must consult Table 8 (RQ6). For barriers from the perspective of an industrial expert, the results in Table 9 (RQ7) are beneficial. For the association of barriers and SOP formation or contract renovation, refer to the analysis results based on Fisher's exact test (Table 10, RQ8).

We have noted the following points, as a plan, from the findings of this study:

- The barriers will be identified and analyzed in SOP relationships from client's perspectives
- To find the underlying reasons, why some barriers are not important for the specific group of SDO organizations
- To determine, through empirical study, the implementation initiatives of the barriers which have been frequently cited in our study.
- To determine, through empirical study, the underlying reasons why these barriers are still being faced.

## APPENDIX A

Table 17. Reference traceability Table

## APPENDIX B

Table 18. Hypothesis for association

## APPENDIX C

Table 19. Criticality Table

**TABLE 21.** List of finally selected papers.

| R | First Author | Venue | Title | J. Vol & Conf. Loc | Pages | Year |
|---|---|---|---|---|---|---|
| 1 | S. Dhar | Journal of Global Information Management | Risks, Benefits, and Challenges in Global IT Outsourcing: Perspectives and Practices | 14(3) | 39-69 | 2006 |
| *2* | *E. Hossain* | *16th Asia-Pacific Software Engineering Conference* | *Risk Identification and Mitigation Processes for Using Scrum in Global Software Development: A Conceptual Framework* | | *457-464* | *2009* |
| 3 | A.S. AL_Zaidi | International Journal of Information Engineering and Electronic Business | Scrum Practices and Global Software Development | 5(2014) | 22-28 | 2014 |
| 4 | B. QUE´ LIN | European Management Journal | Bringing Together Strategic Outsourcing and Corporate Strategy: Outsourcing Motives and Risks | 21(5) | 647–661 | 2003 |
| 5 | H. Gewald | Information & Management | Risks and benefits of business process outsourcing: A study of transaction services in the German banking industry | 46(2009) | 249–257 | 2009 |
| 6 | T. Herath | Information Systems Management | Offshore Outsourcing: Risks, Challenges, and Potential Solutions | 26(4) | 312-326 | 2009 |
| 7 | R. Hahn | Journal of Business Research | Resources and governance in "base of the pyramid"-partnerships: Assessing collaborations between businesses and non-business actors | 67(2014) | 1321–1333 | 2014 |
| 8 | J. Chou | Cities | Strategic governance for modeling institutional framework of public–private partnerships | 42 (2015) | 204–211 | 2015 |
| 9 | M.D. Aundhe | European Management Journal | Risks in offshore IT outsourcing: A service provider perspective | 27(2009) | 418– 428 | 2009 |
| *10* | *E. Beulen* | *First Information Systems Workshop on Global Sourcing: Services, Knowledge and Innovation* | *The management of global sourcing partnerships: Implications for the capabilities and skills of the IS function* | *Val d'Isère, France* | *1-24* | *2007* |
| 11 | S.Ren | International Journal of Production Research | Examining the determinants of outsourcing partnership quality in Chinese small- and medium-sized enterprises | 48(2) | 453–475 | 2010 |
| **12** | **S. Ajitkumar** | **Open IT-Based Innovation: Moving Towards Cooperative IT Transfer and Knowledge Diffusion** | **A study of the risks in an Information system outsourcing Partnership** | **IFIP, Springer** | **403-422** | **2008** |
| 13 | G. Gong | Discrete Dynamics in Nature and Society | A Novel Dynamic Algorithm for IT Outsourcing Risk Assessment Based on Transaction Cost Theory | 1(2015) | 1-10 | 2014 |
| *14* | *J. Li* | *14th Asia-Pacific Software Engineering Conference* | *A Survey on the Business Relationship between Chinese Outsourcing Software Suppliers and Their Outsourcers* | | *470-477* | *2007* |
| 15 | B.L. Kedia | Journal of International Management | International outsourcing of services: A partnership model | 13(2007) | 22–37 | 2007 |
| 16 | S.M. Handley | Journal of Operations Management | Unlocking the business outsourcing process model | 27(2009) | 344-361 | 2009 |
| 17 | J. Rhodes | Service Business | Critical success factors in relationship management for services outsourcing | 10(2016) | 59-86 | 2016 |
| 18 | J. Nool | ACM Introads | Global Software Development And Collaboration: Barriers and Solutions | 1(3) | 66-78 | 2010 |
| 19 | A.Tiwana | Strategic Management Journal | Research notes and commentaries does interfirm modularity complement ignorance? A field study of software outsourcing alliances | 29(2008) | 1241-1252 | 2008 |
| 20 | M. C. Lacity | Journal of Strategic Information Systems | A review of the IT outsourcing literature: Insights for practice | 18(2009) | 130-146 | 2009 |
| 21 | A.Nguyen-Duc | Information and Software Technology | The impact of global dispersion on coordination, team performance and software quality – A systematic literature review | 57(2015) | 277–294 | 2015 |
| 22 | R. V. Tulder | Journal of Business Ethics | Enhancing the Impact of Cross-Sector Partnerships Four Impact Loops for Channeling Partnership Studies | 135(1) | 1-17 | 2015 |
| 23 | A.Gurung | Journal of Global Information Technology Management | A Research Framework for the Impact of Cultural Differences on IT Outsourcing | 9(1) | 24-43 | 2006 |
| *24* | *K. Väyrynen* | *44th Hawaii International Conference on System Sciences* | *Investigating the Differences between Success Factors of Conventional IS Outsourcing and Quasi-Outsourcing* | *Hawaii, USA* | *1-10* | *2011* |
| *25* | *S. Betz* | *International Conference on Global Software Engineering* | *Knowledge Transfer in IT Offshore Outsourcing Projects: An Analysis of the Current State and Best Practices* | | *330-335* | *2010* |
| 26 | B. L. Rau | Human Resource Management Review | The diffusion of HR practices in unions | 22(2012) | 27-42 | 2012 |
| 27 | D. C. Chou | Computer Standards & Interfaces | Information systems outsourcing life cycle and risks analysis | 31(2009) | 1036-1043 | 2009 |
| 28 | *B. Yang* | *International conference on electronic commerce* | *The Integration Mechanism of IT Outsourcing Partnership* | *Xi'an, China* | *801-803* | *2005* |
| 29 | *L. W. Yang* | *International Conference on E-Business and Internet* | *Partners' Characteristics and Stock Performance in Strategic Alliances* | *Taichung, Taiwan* | *54-59* | *2017* |
| 30 | *S. Liu* | European Journal of Operational Research | Effects of process and outcome controls on business process outsourcing performance: Moderating roles of vendor and client capability risks | 260(2017) | 1115-1128 | *2017* |
| 31 | T. Kern | Journal of Strategic Information System | Exploring ASP as sourcing strategy: theoretical perspectives, propositions for practice | 11(2002) | 153-177 | 2002 |

**TABLE 21.** ***(Continued.)*** **List of finally selected papers.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 32 | L. J. Ryals | Business Horizons | Holding up the mirror: The impact of strategic procurement practices on account management | 49(2006) | 410-50 | 2006 |
| 33 | D. Mukherjee | Journal of International Management | Creating value through offshore outsourcing: An integrative framework | 19(2013) | 377-389 | 2013 |
| 34 | N. Mehta | Communications of the ACM | It Takes Two to Tango: How Relational Investments Improve IT Outsourcing Partnerships | 53(2) | 160-164 | 2010 |
| 35 | S.U. Khan | Information and Software Technology | Barriers in the selection of offshore software development outsourcing vendors: An exploratory study using a systematic literature review | 53(2011) | 639-704 | 2011 |
| 36 | R. Gonzalez | Industrial Management and Data Systems | Information systems outsourcing reasons and risks: a new assessment | 110(2) | 284-303 | 2010 |
| 37 | K. M. Green | American Journal of Management | Project Scope, Market Size Prospects, and Launch Outcomes in Cooperative New Product Development | 13(2) | 41-54 | 2013 |
| *38* | *M. Kinnula* | *40th Hawaii International Conference on System Sciences* | *The Formation and Management of a Software Outsourcing Partnership Process* | *Hawaii, USA* | *1-10* | *2007* |
| 39 | M-C.Tsai | Transportation Research Part E | The dark side of logistics outsourcing Unraveling the potential risks leading to failed relationships | 48(2012) | 178-189 | 2012 |
| 40 | B. C. Adeleye | International Journal of Information Management | Risk management practices in IS outsourcing: an investigation into commercial banks in Nigeria | 24(2004) | 167-180 | 2004 |
| *41* | *E. Wende* | *48th Hawaii International Conference on System Sciences* | *Exploring Storytelling for Relationship Building in Offshore Outsourced Projects: An Action Research Investigation* | *Hawaii, USA* | *412-421* | *2015* |
| *42* | *B. Yang* | *International conference on electronic commerce* | *A Case Study of Disaster Backup Outsourcing of SDB and Hi Sun* | *Xi'an, China.* | *795-797* | *2005* |
| *43* | *H.C. Estler* | *9th International Conference on Global Software Engineering* | *Awareness and Merge Conflicts in Distributed Software Development* | *Shanghai, China* | *26-35* | *2014* |
| *44* | *M. Alexandrova* | *5th Virtual International Conference on Advanced Research in Scientific* | *IT Outsourcing Risks: Empirical Evidence from Bulgarian Service Providers* | *Slovakia* | *29-33* | *2012* |
| 45 | E. Lioliou | Journal of Information Technology | Vendor Opportunism in IT Outsourcing: A TCE and Social Capital Perspective | 30(4) | 307-324 | 2015 |
| 46 | Y. L. Antonucci | Information Strategy: The Executive's Journal | IT Outsourcing: Current Trends, Benefits, and Risks | 14(2) | 16-26 | 2013 |
| 47 | A. Balogun | Master's Thesis in Business Administration, School of Management, Blekinge Tekniska Högskola, Sektionen för management | An evaluation of the risks involved in onshore IT outsourcing –case study of Citiserve Limited, Lagos Nigeria | Karlskrona, Sweden | P.100 | 2010 |
| 48 | Z. Hansen | European Management Journal, | Outsourcing relationships: Changes in power and dependency | 31(2013) | 655– 667 | 2013 |
| 49 | C. Hsu | Journal of Air Transport Management | An outsourcing provider decision model for the airline industry | 28(2013) | 40-46 | 2013 |
| 50 | P. Teirlinck | Technovation | Research collaboration and R&D outsourcing: Different R&D personnel requirements in SMEs | 33(2013) | 142-153 | 2013 |
| 51 | L.M. Abdullah | The Journal of Systems and Software | Analysis and application of an outsourcing risk framework | 85(2012) | 1930-1952 | 2012 |
| 52 | S. J. Ren | IEEE Transactions On Engineering Management | Managing Software Outsourcing Relationships in Emerging Economies: An Empirical Study of the Chinese Small- and Medium-Sized Enterprises | 58(4) | 730-742 | 2011 |
| 53 | A. Vorontsova | Procedia Technology | Determinants of IT Outsourcing Relationships: A Recipient - Provider Perspective | 16(2014) | 588-597 | 2014 |
| 54 | C. Samantra | Expert Systems with Applications | Risk assessment in IT outsourcing using fuzzy decision-making approach: An Indian perspective | 41(2014) | 4010-4022 | 2014 |
| 55 | A.Agarwal | Journal of Internet Banking and Commerce | Partner Relationship Management (PRM) Index: An Innovative Approach For Enhancing Channel Partner Relationships | 19(1) | 1-25 | 2014 |
| 56 | J.M. Verner | Information and Software Technology | Risks and risk mitigation in global software development: A tertiary study | 56(2014) | 54-78 | 2014 |
| 57 | C. Catal | ACM SIGSOFT Software Engineering Notes | Barriers to the adoption of software product line engineering | 34(6) | 1-4 | 2009 |
| 58 | P. Trkman | Journal of Strategic Information Systems | Knowledge risks in organizational networks: An exploratory framework | 21(2012) | 1-17 | 2012 |
| 59 | A. Hoech | Technovation | Innovation risks of strategic outsourcing | 26(2006) | 672–681 | 2006 |
| 60 | S. K. Mathew | Journal of Strategic Information Systems | Achieving offshore software development success: An empirical analysis of risk mitigation through relational norms | 22(2013) | 298-3124 | 2013 |
| 61 | D. Whitten | Journal of Strategic Information Systems | Measuring switching costs in IT outsourcing services | 15(2006) | 219-248 | 2006 |
| 62 | M.I. Khan | Proceedings of the Pakistan Academy of Sciences | Critical Barriers in Project Management Faced by Offshore Software Multi-Sourcing Vendors: A Detailed Study | 53(3) | 267-280 | 2016 |
| 63 | A.A. Khan | IEEE Access | SPIIMM: Toward a Model for Software Process Improvement Implementation and Management in Global Software Development | 5(2017) | 13720-13741 | 2017 |

**TABLE 21.** ***(Continued.)*** **List of finally selected papers.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 64 | T.S.H. Teo | Information & Management | Knowledge transfer and utilization in IT outsourcing partnerships: A preliminary model of antecedents and outcomes | 51(2014) | 177–186 | 2014 |
| 65 | G.P.A.J. Delen | Science of Computer Programming | Lessons from Dutch IT-outsourcing success and failure | 130(2016) | 37-68 | 2016 |
| 66 | M .Niazi | IET Software | Establishing trust in offshore software outsourcing relationships: an exploratory study using a systematic literature review | 7(5) | 283–293 | 2013 |
| 67 | R. Heeks | IEEE Software | Synching or Sinking: Global Software Outsourcing Relationships | 18(2) | 55-60 | 2001 |
| 68 | S. U. Khan | IET Software | Critical challenges in managing offshore software development outsourcing contract from vendors' perspectives | 11(1) | 1-11 | 2016 |
| 69 | *I. Shaanika* | *IST-Africa 2017 Conference Proceedings* | *Managing IT Skills Transfer in an Outsourcing Partnership within the Namibian Ministries Computing Environment* | *Durban, South Africa* | *1-10* | *2017* |
| 70 | J-N. Lee | IEEE Transactions on Engineering Management | Understanding Outsourcing Partnership: A Comparison of Three Theoretical Perspectives | 52(1) | 43-58 | 2005 |
| 71 | Z. Wei | IEEE Transactions on Engineering Management | Outsourcer Knowledge Protection, Psychological Contract Schema, and Project Performance: A Vendor's Perspective | 65(1) | 128-140 | 2018 |
| 72 | S. U. Khan | IET Software | Intercultural challenges in offshore software development outsourcing relationships: an exploratory study using a systematic literature review | 8(4) | 161-173 | 2014 |
| 73 | R. P. Jain | IEEE Transactions on Engineering Management | An Empirical Investigation of Client Managers' Responsibilities in Managing Offshore Outsourcing of Software-Testing Projects | 58(4) | 743-757 | 2011 |
| 74 | B. Shahzad | IEEE Access | Build Software or Buy: A Study on Developing Large Scale Software | 5(2017) | 24262- 24274 | 2017 |
| 75 | A.Gopal | IEEE Transactions on Engineering Management | Coordination and Performance in Global Software Service Delivery: The Vendor's Perspective | 58(4) | 772-785 | 2011 |
| 76 | S. Sundararajan | IET Software | Case study on risk management practice in large offshore-outsourced Agile software projects | 8(6) | 45–257 | 2014 |
| 77 | X. Zhu | Transportation Research Part E | Managing the risks of outsourcing: Time, quality and correlated costs | 90(2016) | 121-133 | 2016 |
| 78 | *J. Varajão* | Procedia Computer Science | IT/IS Outsourcing in Large Companies – Motivations and Risks | 121(2017) | 1047-1061 | 2017 |
| 79 | S. Gopala krishnan, | Journal of Business Research | Client dependence: A boon or bane for vendor innovation? A competitive mediation framework in IT outsourcing | | | 2018 |
| 80 | E. Verwaal | Journal of World Business | Global outsourcing, explorative innovation and firm financial performance: A knowledge exchange based perspective | 52(2017) | 17-27 | 2017 |
| 81 | Q. Yang | Int. J. Production Economics | Improving logistics outsourcing performance through transactional and relational mechanisms under transaction uncertainties: Evidence from China | 175(2016) | 12-23 | 2016 |
| 82 | A-M. Søderberg | Journal of International Management | Global Software Development: Commitment, Trust and Cultural Sensitivity in Strategic Partnerships | 19(2013) | 347-361 | 2013 |
| 83 | D.Assmann | Computers in Industry | Towards partnership in software subcontracting | 54(2004) | 137-150 | 2004 |
| 84 | J. Hagedoorn | Academy of Management Review | Understanding the Cross-Level Embeddedness Of Interfirm Partnership Formation | 31(3) | 670-680 | 2006 |
| 85 | *M. Zeng* | Academy of Management Review | Achieving Cooperation In Multiparty Alliances: A Social Dilemma Approach To Partnership Management | *28(4)* | 587-605 | *2003* |
| 86 | *M. A. Koschmann* | *Academy of Management Review* | *A Communicative Framework of Value In Cross-Sector Partnerships* | *37(3)* | 332-354 | *2010* |
| 87 | F. Ahmed | IET Software | Analysis of risks faced by information technology offshore outsourcing service providers | 8(6) | 279-284 | 2014 |
| 88 | O. Ee | Service Business | The effects of partnership quality on business process outsourcing success in Malaysia: key users perspective | 7(2013) | 227–253 | 2013 |
| 89 | N. B. Moe | Empirical Software Engineering | From offshore outsourcing to insourcing and partnerships: four failed outsourcing attempts | 19(2014) | 225–1258 | 2014 |
| 90 | *K.M. Tan* | *Review of Industrial Organization* | Outsourcing and Price Competition: An Empirical Analysis of the Partnerships Between Legacy Carriers and Regional Airlines | | 1-20 | *2017* |
| 91 | J.T. Addison | Journal for Labour Market Research | A research note on the determinants and consequences of outsourcing using German data | 44(2011) | 231-244 | 2011 |
| 92 | B. Swar | Information Systems Frontiers | Determinants of relationship quality for IS/IT outsourcing success in public sector | 14(2014) | 457–475 | 2014 |
| 93 | M. Goldberg | Business & Information Systems Engineering | Retained Organizations in IT Outsourcing Linking Organization Design to Outsourcing Management Problems | 59(2) | 111–124 | 2017 |

**TABLE 21.** ***(Continued.)*** **List of finally selected papers.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 94 | L. Söderberg | Operations Management Research | A model for outsourcing and governing of maintenance within the process industry | 10(2017) | 10-20 | 2017 |
| 95 | *J. I. Agbur* | Journal of Global Entrepreneurship Research | Effect of outsourcing strategies on the performance of small and medium scale enterprises (SMEs) | 26(7) | 1-34 | 2017 |
| 96 | M. Polo | Information Technology and Management | Integrating Outsourcing in the Maintenance Process | 3(2002) | 247–269 | 2002 |
| 97 | S.Schneider | Journal of Information Technology | Determinant factors of cloud-sourcing decisions: reflecting on the IT outsourcing literature in the era of cloud computing | 31(2016) | 1-31 | 2016 |
| 98 | J. K. Winkler | Information Systems Frontiers | The impact of cultural differences in offshore outsourcing—Case study results from German–Indian application development projects | 10(2008) | 243–258 | 2008 |
| 99 | G. Erber | Intereconomics | Offshore Outsourcing A Global Shift in the Present IT Industry | 40(2) | 100-112 | 2005 |
| 100 | A.Tiwana | Strategic Management Journal | Does peripheral knowledge complement Control? An empirical test in technology Outsourcing alliances | 28(2007) | 623–634 | 2007 |
| 101 | R. Krishnan | Strategic Management Journal | The Effectiveness of Contractual and Trust-Based Governance In Strategic Alliances Under Behavioral and Environmental Uncertainty | 37(2016) | 2521-2542 | 2016 |
| 102 | X. Yin | Academy of Management Review | Industry Determinants of the "Merger Versus Alliance" Decision | 33(2) | 473–491 | 2008 |
| 103 | *P. J. Ågerfalk* | *MIS Quarterly* | *Outsourcing To An Unknown Workforce: Exploring Opensourcing As A Global Sourcing Strategy* | 33(2) | 385-409 | 2008 |
| 104 | M. Alexandrova | Global Business Review | Risk Factors in IT Outsourcing Partnerships: Vendors' Perspective | 16(5) | 747–759 | 2015 |
| 105 | J.W. Rottman | Information Systems Frontiers | A US Client's learning from outsourcing IT work offshore | 10(2008) | 259-275 | 2008 |
| 106 | M. Larsen | Strategic Management Journal | Uncovering the hidden costs of offshoring: The interplay of complexity, organizational design, and experience | 34(2013) | 533–552 | 2013 |

## APPENDIX D

Table 20. Demographics information

## APPENDIX E

Table 21. List of finally selected papers

Table 21 shows list of included studies in our SLR. The Journal papers are shown in normal style while the conference papers are shown in italic. Moreover, books are shown highlighted by bold while the included thesis has been underlined as shown in Table 21.

## REFERENCES

[1] S. U. Khan, M. Niazi, and R. Ahmad, "Critical success factors for offshore software development outsourcing vendors: An empirical study," in *Proc. PROFES*, in Lecture Notes in Computer Science, vol. 6156. Berlin, Germany: Springer, 2010, pp. 146–160.

[2] S. U. Khan, M. Niazi, and R. Ahmad, "Barriers in the selection of offshore software development outsourcing vendors: An exploratory study using a systematic literature review," *Inf. Softw. Technol.*, vol. 53, pp. 693–706, Jul. 2011.

[3] N. Beaumont and Z. Khan, "A taxonomy of refereed outsourcing literature," Bus. Econ., Monash Univ., Melbourne, VIC, Australia, Working Paper 22/05, 2005.

[4] N. V. Oza, "An empirical evaluation of client-vendor relationships in high maturity Indian software outsourcing companies," Ph.D. dissertation, School Comput. Sci., Univ. Hertfordshire, Hatfield, U.K., 2006.

[5] N. B. Moe, D. Šmite, G. K. Hanssen, and H. Barney, "From offshore outsourcing to insourcing and partnerships: Four failed outsourcing attempts," *Empirical Softw. Eng.*, vol. 19, no. 5, pp. 1225–1258, Oct. 2014.

[6] N. Venkatraman, "Offshoring without guilt," *MIT Sloan Manage. Rev.*, vol. 45, no. 3, pp. 14–16, 2004.

[7] J. Bamford, D. Ernst, and D. G. Fubini, "Launching a world-class joint venture," *Harvard Bus. Rev.*, vol. 82, no. 2, pp. 90–100, 2004.

[8] M. Kinnula, V. Seppanen, J. Warsta, and S. Vilminko, "The formation and management of a software outsourcing partnership process," in *Proc. HICSS*, Waikoloa, HI, USA, Jan. 2007, p. 240.

[9] R. Kishore, H. R. Rao, K. Nam, S. Rajagopalan, and A. Chaudhury, "A relationship perspective on IT outsourcing," *Commun. ACM*, vol. 46, no. 12, pp. 86–92, 2003.

[10] M. Srinivasan, D. Mukherjee, and A. S. Gaur, "Buyer–supplier partnership quality and supply chain performance: Moderating role of risks, and environmental uncertainty," *Eur. Manage. J.*, vol. 29, no. 4, pp. 260–271, 2011.

[11] M. Kinnula and V. Seppänen, "Information technology requirements in an outsourcing partnership," in *Proc. Frontiers E-Bus. Res.*, Tampere, Finland, Sep. 2003, pp. 210–225.

[12] B. L. Kedia and S. Lahiri, "International outsourcing of services: A partnership model," *J. Int. Manage.*, vol. 13, no. 1, pp. 22–37, 2007.

[13] E. Beulen, "The management of global sourcing partnerships: Implications for the capabilities and skills of the is function," in *Proc. 1st Inf. Syst. Workshop Global Sourcing, Services, Knowl. Innov.*, Val-d'Isère, France, 2007, p. 10.

[14] S. Ali, L. Hongqi, and M. F. Abrar, "Systematic literature review of critical barriers to software outsourcing partnership," in *Proc. 5th IMTIC*, Jamshoro, Pakistan, 2018, pp. 1–8.

[15] K. Kemppainen and A. P. J. Vepsäläinen, "Trends in industrial supply chains and networks," *Int. J. Phys. Distrib. Logistics Manage.*, vol. 33, no. 8, pp. 701–719, 2003.

[16] E. García-Canal, C. L. Duarte, J. R. Criado, and A. V. Llaneza, "Accelerating international expansion through global alliances: A typology of cooperative strategies," *J. World Bus.*, vol. 37, no. 2, pp. 91–107, 2002.

[17] F. T. Rothaermel and W. Boeker, "Old technology meets new technology: Complementarities, similarities, and alliance formation," *Strategic Manage. J.*, vol. 29, no. 1, pp. 47–77, 2008.

[18] C. Koh, S. Ang, and G. Yeo, "Does IT outsourcing create firm value?" in *Proc. ACM SIGMIS CPR Conf. Comput. Personnel Res.*, St. Louis, MO, USA, 2007, pp. 87–91.

[19] S. J.-F. Ren, Q. Bu, M.-J. Zhou, and C.-H. Hu, "The influence of inter-enterprise value co-creation on innovation based on resource theories," in *Proc. 19th ICIEEM*, Changsha, China, Oct. 2012, pp. 187–196.
[20] B. Yang, M. Zuo, and X. Yao, "A case study of disaster backup outsourcing of SDB and Hi Sun," in *Proc. ICEC*, Xi'an, China, Aug. 2005, pp. 795–797.
[21] S. M. Miranda and C. B. Kavan, "Moments of governance in IS outsourcing: Conceptualizing effects of contracts on value capture and creation," *J. Inf. Technol.*, vol. 20, no. 3, pp. 152–169, 2005.
[22] T. Kern, J. Kreijger, and L. Willcocks, "Exploring ASP as sourcing strategy: Theoretical perspectives, propositions for practice," *J. Strategic Inf. Syst.*, vol. 11, no. 2, pp. 153–177, 2002.
[23] J. W. Ross, M. R. Vitale, and C. M. Beath, "The untapped potential of IT chargeback," *MIS Quart.*, vol. 23, no. 2, pp. 215–237, 1999.
[24] J. N. Lee, M. Q. Huynh, and R. Hirschheim, "An integrative model of trust on IT outsourcing: Examining a bilateral perspective," *Inf. Syst. Frontiers*, vol. 10, no. 2, pp. 145–163, 2008.
[25] J. H. Dyer, P. Kale, and H. Singh, "When to ally and when to acquire," *MIT Sloan Manage. Rev.*, vol. 42, no. 4, pp. 37–43, 2001.
[26] M. Piltan and T. Sowlati, "Multi-criteria assessment of partnership components," *Expert Syst. Appl.*, vol. 64, no. 1, pp. 605–617, Dec. 2016.
[27] H. Berger and C. Lewis, "Stakeholder analysis is key to client–supplier relationships of global outsourcing project success," *Int. J. Inf. Manage.*, vol. 31, no. 5, pp. 480–485, 2011.
[28] W. R. King, "Outsourcing becomes more complex," *Inf. Syst. Manage.*, vol. 22, no. 2, pp. 89–90, 2005.
[29] J. M. Erickson and C. Ranganathan, "Project management capabilities: Key to application development offshore outsourcing," in *Proc. IEEE 39th HICSS*, Kauai, HI, USA, Jan. 2006, p. 199b.
[30] A. Khalfan, "A case analysis of business process outsourcing project failure profile and implementation problems in a large organisation of a developing nation," *Bus. Process Manage. J.*, vol. 9, no. 6, pp. 745–759, 2013.
[31] L. M. Abdullah and J. M. Verner, "Analysis and application of an outsourcing risk framework," *J. Syst. Softw.*, vol. 85, no. 8, pp. 1930–1952, 2012.
[32] J. M. Verner, O. P. Brereton, B. A. Kitchenham, M. Turner, and M. Niazi, "Risks and risk mitigation in global software development: A tertiary study," *Inf. Softw. Technol.*, vol. 56, no. 1, pp. 54–78, Jan. 2014.
[33] T. L. Tuten and D. J. Urban, "An expanded model of business-to-business partnership formation and success," *Ind. Marketing Manage.*, vol. 30, no. 2, pp. 149–164, 2001.
[34] A. Susarla, "Contractual flexibility, rent seeking, and renegotiation design: An empirical analysis of information technology outsourcing contracts," *Manage. Sci.*, vol. 58, no. 7, pp. 1388–1407, 2012.
[35] J.-S. Chou and D. Pramudawardhani, "Cross-country comparisons of key drivers, critical success factors and risk allocation for public-private partnership projects," *Int. J. Project Manage.*, vol. 33, no. 5, pp. 1136–1150, 2015.
[36] M. Das Aundhe and S. K. Mathew, "Risks in offshore IT outsourcing: A service provider perspective," *Eur. Manage. J.*, vol. 27, no. 6, pp. 418–428, 2009.
[37] S. J.-F. Ren, E. W. T. Ngai, and V. Cho, "Managing software outsourcing relationships in emerging economies: An empirical study of the chinese small- and medium-sized enterprises," *IEEE Trans. Eng. Manag.*, vol. 58, no. 4, pp. 730–742, Nov. 2011.
[38] S. J.-F. Ren, E. W. T. Ngai, and V. Cho, "Examining the determinants of outsourcing partnership quality in Chinese small- and medium-sized enterprises," *Int. J. Prod. Res.*, vol. 48, no. 2, pp. 453–475, 2010.
[39] T. Herath and R. Kishore, "Offshore outsourcing: Risks, challenges, and potential solutions," *Inf. Syst. Manage.*, vol. 26, no. 4, pp. 312–326, 2009.
[40] L. Rusu and G. Hodosi, "Assessing the risk exposure in IT outsourcing for large companies," *Int. J. Inf. Technol. Manage.*, vol. 10, no. 1, pp. 24–44, 2011.
[41] M. Belcourt, "Outsourcing—The benefits and the risks," *Hum. Resource Manage. Rev.*, vol. 16, no. 2, pp. 269–279, 2006.
[42] J. Dibbern, T. Goles, R. Hirschheim, and B. Jayatilaka, "Information systems outsourcing: A survey and analysis of the literature," *ACM SIGMIS Database Adv. Inf. Syst.*, vol. 35, no. 4, pp. 6–102, 2004.
[43] J. W. Rottman and M. C. Lacity, "A US Client's learning from outsourcing IT work offshore," *Inf. Syst. Frontiers*, vol. 10, no. 2, pp. 259–275, 2008.
[44] M.-Y. Wu, H.-P. Chou, Y.-Y. Shih, and J.-H. Wang, "Supply chain performance improvement through partner relationship management in the high tech industry," *Int. J. Manage. Sci. Eng. Manage.*, vol. 6, no. 3, pp. 210–218, 2011.
[45] B. Kitchenham, "Guidelines for performing systematic literature reviews in software engineering," EBSE, Keele Univ., Keele, U.K., Tech. Rep. EBSE 2007-001, 2007.
[46] M. F. Abrar, M. S. Khan, S. Ali, U. Ali, M. F. Majeed, A. Ali, B. Amin, and N. Rasheed, "Motivators for large-scale agile adoption from management perspective: A systematic literature review," *IEEE Access*, vol. 7, pp. 22660–22674, 2019.
[47] A. Nguyen-Duc, D. S. Cruzes, and R. Conradi, "The impact of global dispersion on coordination, team performance and software quality—A systematic literature review," *Inf. Softw. Technol.*, vol. 57, pp. 277–294, Jan. 2015.
[48] R. U. Khan, S. U. Khan, R. A. Khan, and S. Ali, "Motivators in Green IT-outsourcing from Vendor's Perspective: A systematic literature review," *Proc. Pakistan Acad. Sci. J.*, vol. 52, no. 4, pp. 345–360, Dec. 2015.
[49] T. Dybå and T. Dingsøyr, "Empirical studies of agile software development: A systematic review," *Inf. Softw. Technol.*, vol. 50, nos. 9–10, pp. 833–859, 2008.
[50] T. C. Lethbridge, S. E. Sim, and J. Singer, "Studying software engineers: Data collection techniques for software field studies," *Empirical Softw. Eng.*, vol. 10, no. 3, pp. 311–341, Jul. 2005.
[51] J. W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th ed. Newbury Park, CA, USA: Sage, 2017.
[52] S. Wagner, D. M. Fernández, M. Felderer, and D. Winkler, "Status quo in requirements engineering: A theory and a global family of surveys," *ACM Trans. Softw. Eng. Methodol.*, vol. 1, no. 1, pp. 339–355, 2019.
[53] K. Cox, M. Niazi, and J. Verner, "Empirical study of Sommerville and Sawyer's requirements engineering practices," *IET Softw. J.*, vol. 3, no. 5, pp. 339–355, Oct. 2009.
[54] M. Niazi, D. Wilson, and D. Zowghi, "Critical success factors for software process improvement implementation: An empirical study," *Softw. Process, Improvement Pract.*, vol. 11, no. 2, pp. 193–211, 2006.
[55] A. von Eye and E. Y. Mun, *Analyzing Rater Agreement: Manifest Variable Methods*, 1st ed. New York, NY, USA: Psychology Press, 2006.
[56] G. Butterworth, M. Kuchler, and S. Westdijk. *Outsourcing in Europe: An in-Depth Review of Drivers, Risks and Trends in the European Outsourcing Market*. Accessed: Jun. 2018. [Online]. Available: https://www.ey.com/Publication/vwLUAssets/Outsourcing_in_Europe_2013/FILE/EY-outsourcing-survey.pdf
[57] A. Gurung and E. Prater, "A research framework for the impact of cultural differences on IT outsourcing," *Global Sourcing Services, Strategies*, vol. 9, no. 1, pp. 24–43, 2014.
[58] S. K. Mathew and Y. Chen, "Achieving offshore software development success: An empirical analysis of risk mitigation through relational norms," *J. Strategic Inf. Syst.*, vol. 22, no. 4, pp. 298–314, 2013.
[59] M. Zahedi, M. Shahin, and M. A. Babar, "A systematic review of knowledge sharing challenges and practices in global software development," *Int. J. Inf. Manage.*, vol. 36, no. 6, pp. 995–1019, 2016.
[60] J. Corbin and A. Strauss, *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, 4th ed. Newbury Park, CA, USA: Sage, 2014, p. 456.
[61] E. Lioliou and A. Zimmermann, "Vendor opportunism in IT outsourcing: A TCE and social capital perspective," *J. Inf. Technol.*, vol. 30, no. 4, pp. 307–324, 2015.
[62] M. Niazi, N. Ikram, M. Bano, S. Imtiaz, and S. U. Khan, "Establishing trust in offshore software outsourcing relationships: An exploratory study using a systematic literature review," *IET Softw.*, vol. 7, no. 5, pp. 283–293, Oct. 2013.
[63] A. Hoecht and P. Trott, "Innovation risks of strategic outsourcing," *Technovation*, vol. 26, nos. 5–6, pp. 672–681, 2006.
[64] G. P. A. J. Delen, R. J. Peters, C. Verhoef, and S. F. M. van Vlijmen, "Lessons from Dutch IT-outsourcing success and failure," *Sci. Comput. Program.*, vol. 130, no. 201, pp. 37–68, 2016.
[65] M. C. Lacity, S. A. Khan, and L. P. Willcocks, "A review of the IT outsourcing literature: Insights for practice," *J Strategic Inf. Syst.*, vol. 18, no. 3, pp. 130–146, 2009.
[66] A. Gopal, J. A. Espinosa, S. Gosain, and D. P. Darcy, "Coordination and performance in global software service delivery: The vendor's perspective," *IEEE Trans. Eng. Manag.*, vol. 58, no. 4, pp. 772–785, Nov. 2011.

[67] S. Liu, L. Wang, and W. Huang, "Effects of process and outcome controls on business process outsourcing performance: Moderating roles of vendor and client capability risks," *Eur. J. Oper. Res.*, vol. 260, no. 3, pp. 1115–1128, 2017.

[68] S. Dhar and B. Balakrishnan, "Risks, benefits, and challenges in global IT outsourcing: Perspectives and practices," *J. Global Inf. Manage.*, vol. 14, no. 3, pp. 59–89, 2006.

[69] S. Ajitkumar, D. Bunker, S. Smith, and D. Winchester, "A study of the risks in an information system outsourcing partnership," in *Proc. IFIP Working Conf.*, Boston, MA, USA, 2008, pp. 403–422.

[70] J. Rhodes, P. Lok, W. Loh, and V. Cheng, "Critical success factors in relationship management for services outsourcing," *Service Bus.*, vol. 10, no. 1, pp. 59–86, 2016.

[71] J. Li, J. Ma, R. Conradi, W. Chen, J. Ji, and C. Liu, "A Survey on the business relationship between Chinese outsourcing software suppliers and their outsourcers," in *Proc. 14th Asia–Pacific Softw. Eng. Conf.*, Aichi, Japan, 2007, pp. 470–477.

[72] R. Heeks, S. Krishna, B. Nicholsen, and S. Sahay, "Synching or sinking: Global software outsourcing relationships," *IEEE Softw.*, vol. 18, no. 2, pp. 54–60, Mar. 2001.

[73] D. Mukherjee, A. S. Gaur, and A. Datta, "Creating value through offshore outsourcing: An integrative framework," *J. Int. Manage.*, vol. 19, no. 4, pp. 377–389, 2013.

[74] C. Samantra, S. Datta, and S. S. Mahapatra, "Risk assessment in IT outsourcing using fuzzy decision-making approach: An Indian perspective," *Expert Syst. Appl.*, vol. 41, no. 8, pp. 4010–4022, 2014.

[75] M.-C. Tsai, K.-H. Lai, A. E. Lloyd, and H.-J. Lin, "The dark side of logistics outsourcing—Unraveling the potential risks leading to failed relationships," *Transp. Res. E, Logistics Transp. Rev.*, vol. 48, no. 1, pp. 178–189, 2012.

[76] S. U. Khan and M. I. Azeem, "Intercultural challenges in offshore software development outsourcing relationships: An exploratory study using a systematic literature review," *IET Softw.*, vol. 8, no. 4, pp. 161–173, Aug. 2014.

[77] J. K. Winkler, J. Dibbern, and A. Heinzl, "The impact of cultural differences in offshore outsourcing–case study results from German–Indian application development projects," *Inf. Syst. Frontiers*, vol. 10, no. 2, pp. 243–258, 2008.

[78] A.-M. Søderberg, S. Krishna, and P. Bjørn, "Global software development: Commitment, trust and cultural sensitivity in strategic partnerships," *J. Int. Manage.*, vol. 19, no. 4, pp. 347–361, 2013.

[79] M. M. Larsen, S. Manning, and T. Pedersen, "Uncovering the hidden costs of offshoring: The interplay of complexity, organizational design, and experience," *Strategic Manage J*, vol. 34, no. 5, pp. 533–552, 2013.

[80] D. Whitten and R. L. Wakefield, "Measuring switching costs in IT outsourcing services," *J. Strategic Inf. Syst.*, vol. 15, no. 3, pp. 219–248, 2006.

[81] T. S. H. Teo and A. Bhattacherjee, "Knowledge transfer and utilization in IT outsourcing partnerships: A preliminary model of antecedents and outcomes," *Inf. Manage.*, vol. 51, no. 2, pp. 177–186, Mar. 2014.

[82] Z. Wei, Z. Du, and Y. Bao, "Outsourcer knowledge protection, psychological contract schema, and project performance: A vendor's perspective," *IEEE Trans. Eng. Manag.*, vol. 65, no. 1, pp. 128–140, Feb. 2018.

[83] S. U. Khan and A. W. Khan, "Critical challenges in managing offshore software development outsourcing contract from vendors' perspectives," *IET Softw.*, vol. 11, no. 1, pp. 1–11, 2017.

[84] E. Verwaal, "Global outsourcing, explorative innovation and firm financial performance: A knowledge-exchange based perspective," *J. World Bus.*, vol. 52, no. 1, pp. 17–27, 2017.

[85] L. Ryals and B. Rogers, "Holding up the mirror: The impact of strategic procurement practices on account management," *Bus. Horizons*, vol. 49, no. 1, pp. 41–50, 2006.

[86] X. Yin and M. Shanley, "Industry determinants of the 'merger versus alliance' decision," *Acad. Manage. Rev.*, vol. 33, no. 2, pp. 473–491, 2008.

[87] R. A. Khan, M. Y. Idris, S. U. Khan, M. Ilyas, S. Ali, A. U. Din, G. Murtaza, and A. W. Wahid, "An evaluation framework for communication and coordination processes in offshore software development outsourcing relationship: Using fuzzy methods," *IEEE Access*, vol. 7, pp. 112879–112906, 2019.

[88] J.-S. Chou, H. P. Tserng, C. Lin, and W.-H. Huang, "Strategic governance for modeling institutional framework of public–private partnerships," *Cities*, vol. 42, pp. 204–211, Feb. 2015.

[89] R. Hahn and S. Gold, "Resources and governance in 'base of the pyramid'-partnerships: Assessing collaborations between businesses and non-business actors," *J. Bus. Res.*, vol. 67, no. 7, pp. 1321–1333, 2014.

[90] N. Mehta and A. Mehta, "It takes two to tango: How relational investments improve IT outsourcing partnerships," *Commun. ACM*, vol. 53, no. 2, pp. 160–164, 2010.

[91] D. Trewin. (Oct. 24, 2019). *Small Business in Australia: 2001. Australian Bureau of Statistics Report 1321.0*. [Online]. Available: https://www.ausstats.abs.gov.au

[92] S. Ali and S. U. Khan, "Software outsourcing partnership model: An evaluation framework for vendor organizations," *J. Syst. Softw.*, vol. 117, pp. 402–425, Jul. 2016.

[93] D. S. Moore, G. P. McCabe, and B. A. Craig, *Introduction to the Practice of Statistics: International Edition*, 9th ed. New York, NY, USA: Freeman, 2016, p. 725.

[94] J. Hagel and J. S. Brown, *Only Sustainable Edge: Why Business Strategy Depends on Productive Friction and Dynamic Specialization*. Boston, MA, USA: Harvard Business Review Press, 2005, p. 218.

[95] A. K. Sangaiah and A. K. Thangavelu, "An exploration of FMCDM approach for evaluating the outcome/success of GSD projects," *Central Eur. J. Eng.*, vol. 3, no. 3, pp. 419–435, Sep. 2013.

[96] S. C. Bhatnagar and S. Madon, "The Indian software industry: Moving towards maturity," *J. Inf. Technol.*, vol. 12, no. 4, pp. 277–288, 1997.

[97] R. Terdiman and F. Karamouzis, "Going offshore to globally source IT services," Gartner Res., Stamford, CA, USA, Tech. Rep. 22/2005, Jun. 2009. [Online]. Available: http://hcm.metagroup.com/resources/103900/103916/103916.pdf

[98] E. O. Conchúir, P. J. Agerfalk, H. H. Olsson, and B. Fitzgerald, "Global software development: Where are the benefits?" *Commun. ACM*, vol. 52, no. 8, pp. 127–131, 2009.

[99] A. Taweel, B. Delaney, T. N. Arvanitis, and L. Zhao, "Communication, knowledge and co-ordination management in globally distributed software development: Informed by a scientific software engineering case study," in *Proc. 4th IEEE Int. Conf. Global Softw.*, Limerick, Ireland, Jul. 2009, pp. 370–375.

[100] S. Ali, L. Hongqi, S. U. Khan, Y. Zhongguo, and Z. Liping, "Success factors for software outsourcing partnership management: An exploratory study using systematic literature review," *IEEE Access*, vol. 5, pp. 23589–23612, 2017.

[101] S. Ali, H. Li, S. U. Khan, Y. Zhao, and L. Li, "Fuzzy multi attribute assessment model for software outsourcing partnership formation," *IEEE Access*, vol. 6, pp. 55431–55461, 2018.

[102] S. Ali and S. U. Khan, "Critical success factors for software outsourcing partnership (SOP): A systematic literature review," in *Proc. 14th Int. Conf. Global Softw. (ICGSE)*, Shanghai, China, 2014, pp. 153–162.

[103] S. Ali, H. Li, S. U. Khan, M. F. Abrar, and Y. Zhao, "Practitioner's view of barriers to software outsourcing partnership formation: An empirical exploration," *J. Softw. Evol.*, vol. 31, no. 10, p. e2233, 2019.

[104] A. U. Alam, S. U. Khan, and I. Ali, "Knowledge sharing management risks in outsourcing from various continents perspective: A systematic literature review," *Int. J. Digit. Content Technol. Appl.*, vol. 6, no. 21, p. 27, 2012.

[105] S. Ali, H. Li, S. U. Khan, and Y. Zhongguo, "Practices in software outsourcing partnership: Systematic literature review protocol with analysis," *J. Comput.*, vol. 13, no. 6, pp. 839–861, 2017.

[106] S. Lahiri and B. L. Kedia, "The effects of internal resources and partnership quality on firm performance: An examination of Indian BPO providers," *J. Int. Manage.*, vol. 15, no. 2, pp. 209–224, 2009.

[107] S.-Y. Sun, T.-C. Lin, and P.-C. Sun, "The factors influencing information systems outsourcing partnership-a study integrating case study and survey research methods," in *Proc. 35th HICSS*, Big Island, HI, USA, 2002, pp. 2810–2819.

[108] H. Coolican, *Research Methods and Statistics in Psychology*, 7th ed. London, U.K.: Routledge, 2018.

[109] S. U. Khan and S. Ali, "Empirical investigation of success factors for establishing software outsourcing partnership from vendor's perspective," *Proc. Pakistan Acad. Sci. J.*, vol. 52, no. 4, pp. 315–328, 2015.

[110] S. U. Khan and M. Niazi, "Critical challenges in offshore software development outsourcing: An empirical study," in *Proc. Softw. Eng., Control Appl.*, 2012, pp. 1–10.

[111] M. Niazi, D. Wilson, and D. Zowghi, "A maturity model for the implementation of software process improvement: An empirical study," *J. Syst. Softw.*, vol. 74, no. 2, pp. 155–172, 2005.

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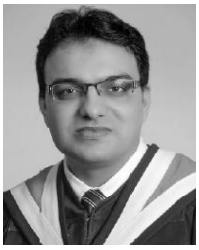

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