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in-house software development capability and to reduce processing costs.[3] However, the scope of SDO is expanding. Today s organisations not only outsource to reduce cost but to improve the company s overall working performance.[4]

Meanwhile, different kinds of companies having different types of requirements, consequently, considerably many varieties of associations are obligatory.[5] SDO organisations nowadays use a diversity of methods to outsource software development tasks such as they subcontract, develop in-house, broaden in-house competence via acquirements form joint ventures, and shape partnerships with overseas organisations.[5] Due to big economic changes, globalisation, antagonism from low remuneration unindustrialised countries, and improvements in ICTs, from 1980 onwards numerous business networks have been formed such as multisourcing, strategic networks, different kinds of alliances, coalition, association, joint-ventures, and partnership etc..[6] Organisational relationships in these networks go beyond the traditional order and supply trades.[7] In this type of relation, everything like profits, losses, investments, risks, and work burden are distributed amongst the partners organisations.[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 is over passing the conventional old-style organisational boundaries.[8] A partnership is a long-lasting bidirectional association where confidential data regarding future plans and schemes are shared with each other willingly.[11]

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"*.[8] In SOP, an organisation develops mutually beneficial policies and plans.[8] In this type of relationship, stakeholders openly share risks, rewards, and workload.[12] It lets the client and vendor focus on their resources in the right track.[11]

1.1 | Research objective

The objective of this research paper is to develop a framework for modelling structural association amongst a list of barriers that are obstacles for vendors in the renovation or upgradation of their ongoing contractual outsourcing relationship into a partnership. To achieve our objective, this study implements Interpretive Structural Model (ISM) and Matrice d Impacts Croises—Multiplication Applique a Classement (MICMAC) approach to reconnoiter the interrelationships amongst the barriers. For this purpose, we have executed an empirical survey based on the initial findings of the SLR. The SLR findings were used as input for the empirical survey while the findings of the empirical survey were used to develop ISM-based SOP barriers association (SOPBA) model. For ISM study, from the participants of the major survey, a panel of 10 experts was selected based on their experiences.

The following research questions were addressed:

RQ1. What are the critical barriers, as reported in the literature, that restrict outsourcing clients from renovation or upgradation of their existing contractual outsourcing association into an outsourcing partnership with vendor organisation?

RQ2. What are the critical barriers, as reported by the experts through empirical survey that restrict outsourcing clients from renovation or upgradation of their existing contractual outsourcing association into an outsourcing partnership with vendor organisations?

RQ3. What are the interrelationships amongst the identified barriers?

RQ4. What are the driving and dependence power of the identified barriers?

We have published the SLR protocol with initial results related to RQ1 in a conference paper.[13] This is an extended version of the conference paper in which we have revised the SLR results by increasing sample size from 65 to 106. For this purpose, do manual search and extend the time period from September 2016 to March 2018 while applying the same search string. Further, some novel results based on the empirical survey from RQ2 to RQ4 are also presented in this paper. Specifically, in this paper, we have extended our work by adding the following details:

- In response to RQ 1—based on the SLR, a complete result with comprehensive explanation are presented in Section 4.1.
- In response to RQ 2—based on the SLR results, a questionnaire survey was executed. We present the results and analysis based on the empirical study in Section 4.2.
- In response to RQ 3—ISM approach was used to inter-relate the barriers. We present the results and analysis based on the ISM-based study in Section 4.3.

- In response to RQ 4—MICMAC technique was used to classify the barriers. We present the results and analysis based on the empirical study in Section 4.4.

The overarching goal of the research project is to develop a barrier evaluation and mitigation model to be used by SDO vendor organisations. This model will assist SDO vendor organisations in measuring and improving their outsourcing readiness prior to starting outsourcing partnership formation or contract renewal activities.

1.2 | Paper outline

The paper is organised as follows: Section 2 presents background and motivation. Section 3 describes the research methodologies. Section 4 presents the results. Section 5 summarises and discussed the results. Section 6 discussed the limitations of the study, while Section 7 concludes the paper by mentioning future work.

2 | BACKGROUND AND MOTIVATION

In the past two decades, to stay in the market competition, outsourcing partnerships have arisen as one of the important mechanism for growing organisations.[11,14] Partnerships can benefit organisations to carry on competing by increasing competences,[14] developing innovative products,[11] connecting to new markets,[15] and gaining access to new resource pool.[16] At present, numerous new companies get involved in the global outsourcing of products and services.[11] For instance, to increase benefits and overcome problems, many organisations have established partnerships. These include Universal Postal Service and Motorola,[17] Kodak and digital equipment corporation, and IBM,[18] Shenzhen development bank and Hi Sun,[19] United States Achievement Academy and IBM,[18,20] Electronic data systems and Xerox,[20] Price-water-house-coopers and KPMG,[21] EC_Gate and Cap_Gemini,[21] Cisco, Corio, Sun, and DELL,[21] and Microsoft Net store, and US internetworking.[21] In view of Ross et al,[22] previous research does not report reasons and factors of partnership formation.

Client organisation typically creates SOP with counterpart vendor organisation for access to new technology, markets, and complementary skills, or to reduce uncertainty and to improve profit and product quality.[23] 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 a software with very merciless quality).[24] Regardless of numerous benefits, the development of SOP still remnants in its infancy stage due to several interactive barriers.

Engaging in partnership with other firms might decrease firms developmental cost. A study carried out by Piltan et al[25] found that above 80% of CEOs believed that outsourcing partnerships were the core source of generating nearly 26% of their company revenues. However, SOP is not a risk-free trade; significant numbers of failure cases have also been reported.[26-28] According to the literature,[5,25,29] outsourcing partnership has a high disappointment rate. According to King,[27] JP Morgan did 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.[30] Erickson et al[28] 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 et al[25] reported the failure ratio of outsourcing partnerships from 30% to 70%. Several risks for partnership formation have been reported in the academic literature, with more concentration on the vendor opportunism, service disagreement, extreme dependency on a vendor, financial loss and erosion of capabilities like core skills, personnel, and innovative capabilities.[31]

Kinnula et al[8] argue that previous research does not report how a partnership is formed. According to Ren et al,[18] preceding literature on outsourcing partnerships 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 recognise the importance of pre-implementation stage factors, which may determine partnership quality.

Some studies have been conducted to examine the barriers to SOP formation such as Tuten and Urban,[32] Susarla,[33] Verner et al,[31] Chou and Pramudawardhani,[34] Aundhe and Mathew,[35] Kinnula et al,[8] Ren et al,[18] and Abdullah and Verner.[30] However, no attempt was made to explore the multifaceted interrelationships amongst them. Further, Piltan and Sowlati[25] considered partnership formation as a multicriteria decision making (MCDM) problem. Therefore, unlike other researchers, we consider the SOP formation problem as an MCDM problem. Because, several quantitative and qualitative factors impact the SOP formation decision, signposts that the SOP formation problem is an MCDM problem. ISM approach is an application of MCDM that explains the complex pattern of associations by incorporating simple notations of graph theory.[36-38] Therefore, to bridge these gaps, this study implements the ISM approach to reconnoiter the interrelationships amongst the barriers.

Additionally, we have incorporated the ISM approach to handle uncertainty, vagueness, human biases, and expert heterogeneity. According to Kou et al,[39] real-world judgment making problems are usually based on subjective data provided by the expert evaluator. According to Prodanovic,[40] in practice, experts usually have to make a decision with incomplete, imprecise, or vague data. Uncertainty in data means vagueness; it may be due to poorly defined boundaries of scale.[41] Vagueness exists in the natural language terms, such as much smaller than, much better than, good or best, important, significant, considerable, fully implemented, partially implemented, not implemented, achieved, achieving, qualified,

marginally qualified or outstanding, etc..[42,43] For the stated reasons, a good evaluation model must tolerate ambiguity or vagueness.[43-45] As each expert has a different knowledge level, complex judgment making experiences, and preference structures,[44,46] therefore, a good model must involve many field experts.[47]

To answer RQ3 and RQ4, ISM approach along with MICMAC techniques has been used. These methods transform vague, unclearly verbalised interpretive relation into visible, properly defined models valuable for many problems by imposing direction and order to the multifaceted associations.[48,49] Furthermore, in the existing studies, no SLR process has been used to systematically identify barriers from the literature before those barriers can be used in the surveys. In addition, no structural interaction model can be found to associate barriers in the SOP formation or renovation of enduring contract. Our results have complimented the studies conducted/published so far in the domain of SOP. Further, no sufficiently broad framework for the inner association amongst barriers and its ongoing classification in connection to the formation of an outsourcing partnership can be found in the relevant literature.

To address the aforementioned gaps, this study takes the issue from a vendor s perspective and targets to fill a particular gap by identifying and analysing the barriers, through systematic literature review (SLR) and empirical survey.

2.1 | Summary of the related literature on interpretive structural modelling (ISM) approach

For instance, Majumdar et al,[50] Muduli et al,[51] and Diabat and Govindan[48] analysed factors and drivers to green supply chain management, while Hussain et al,[52] explore the dimension of supply chain alternatives evaluation via ISM. Li et al,[53] Trivedi et al,[54] and Gao et al[55] applied the ISM to food and water management, Trivedi et al ,[54] to waste management, Rajaprasad and Chalapathi,[56] to safety management, and Lim et al[57] to supply chain knowledge management.

Tuan[58] explores the drivers of AIDS pandemic exploration in Africa, Potdar et al[59] explore the impediments to agile manufacturing, Awan et al[60] explore the influential factors of manufacturing sustainability, while Astri,[61] explores the factors of cloud adoption through ISM. Wu et al[62] perform supply chain performance analysis, Sajid et al[63] perform biodiesel risk factor and performance analysis, Chandramowli et al,[64] perform analysis on barriers in landfill communities, while Ravi and Shankar[37] perform reverse logistic analysis on various barriers using ISM.

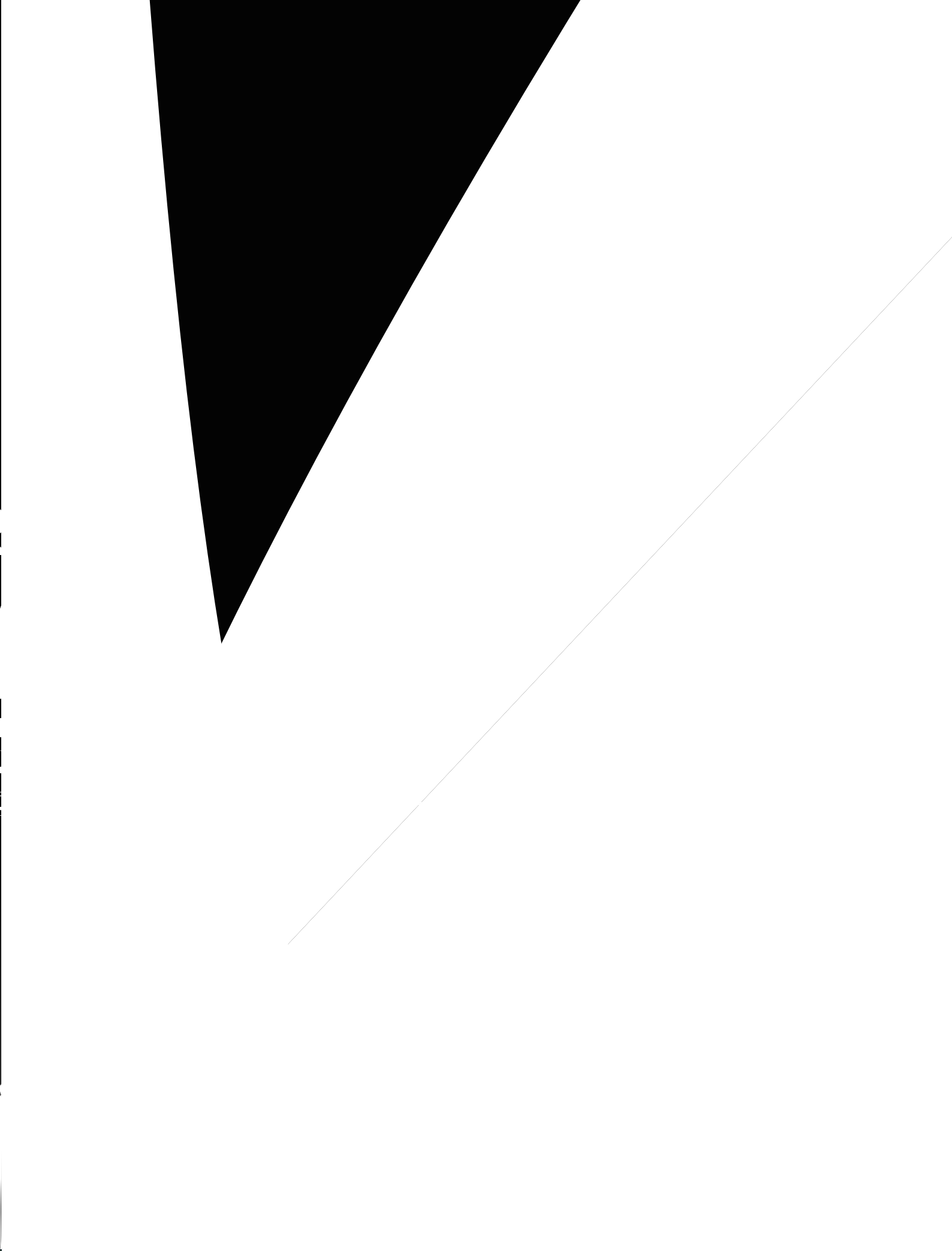
Valmohammadi and Dashti[65] associate barriers to E-commerce implementation, Mishra et al[66] identify association between various practices in maintenance systems, Shen et al[67] interrelate factors of emission trading system implementation, Al-Muftah et al,[68] find interrelation amongst various factors in e-diplomacy implementation, and Gan et al[69] find structure association amongst barriers to construction site implementation using the ISM approach. A summarised view of the literature on ISM is presented in Table 1.

Although ISM approach is widely adopted by numerous investigators of different industries in a simplified way for exploring the primary and secondary connection amongst the identified influential variables, there is lack of studies that adopted ISM approach in the software engineering domain. The only study that incorporated ISM in the software engineering domain was conducted by Sharma and Sangal,[70] but their study lies outside the software outsourcing domain. Furthermore, in the existing studies, no SLR process has been used to systematically identify barriers from the literature before those barriers can be used in the empirical surveys. The ISM methodology is introduced in the next section, and its different steps are explained in details in Section 4.

3 | RESEARCH METHODOLOGY

To achieve our research objective, a hybrid research method was used as illustrated in Figure 1. Firstly, though SLR, we identified 27 barriers to SOP formation from a sample of 106 papers. Secondly, a questionnaire survey, based on the findings of the SLR, was performed with 50 experts from a total of 20 different countries to validate the SLR findings and to draw the perceptions of experts concerning the barriers. The barriers which were considered critical in SOP formation or contract renovation by experts were put forward for further analysis through ISM and MICMAC technique using expert panel review. ISM was used to draw the perceptions of experts concerning the relative inter-relationships amongst these barriers to identify the direct and indirect associations amongst the identified barriers.

These methods transform vague, unclearly verbalised interpretive relation into visible, properly defined models valuable for many problems by imposing direction and order to the multifaceted associations.[48,49] ISM methodology was formulated by Warfield in 1974,[73] as a mediating channel for complex multifaceted association amongst the factors. ISM approach is an application of MCDM that explains the complex pattern of association by incorporating simple notations of graph theory.[36-38,74] It is worth noting that, unlike Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Analytic Hierarchy Process (AHP), and Analytic Network Process (ANP) for establishing the association amongst the listed barriers, the ISM approach does not need the dominance level of the factors or barriers. This assists in decreasing the expert s prejudice and subjectivity while developing the association amongst various predictors and ultimately refining the reliability of the model. It offers a clear understanding of the model variables and assists experts to detect structure within the identified variables (barriers).[75-77] By incorporating the ISM approach, the initial reachability matrix (RM) based on the structural self-interaction matrix (SSIM) was



3.1 | Data collection (Barriers identification)

The outcomes of this study are based on the data collected in three phases as presented below:

Phase 1. (SLR): In the first phase of data collection, various barriers that inhibit vendors to renew or upgrade their existing SDO contract-based relationships with their clients to a more trustee partnerships were identified. Prior to conduct the SLR, we had designed a review plan specifically known as a protocol. The protocol explains different phases of the SLR and can be found in our protocol paper published earlier.[13]

By using major search string, as identified in the SLR protocol, on the selected publisher sites, we found 3303 papers. Only 110 out of 3303 articles qualified the inclusion/exclusion measures. Finally, the duplication was detached by excluding four articles from the finally selected list of articles, which appeared in more than one sources. We got a final sum of 106 articles. To decrease the primary reviewer s bias, the inter-rater reliability was checked by taking 20 randomly selected papers from the primarily selected papers. The two secondary reviewers applied the inclusion/exclusion and quality criteria to make the final selection. Likewise, the two secondary reviewers also selected 20 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 primary and secondary reviewers. Kendall s W ranges from Zero (complete disagreement) to one (complete agreement).[78] The outcomes of SLR study are presented in Table 3.

Phase 2. (Empirical survey): In the second phase, we have steered an empirical investigation through an online survey using the online survey tool, ie, Google Drive, in the software outsourcing industry. The purpose of the survey is twofold: (a) to validate the SLR outcomes and (b) to gain the opinions of the experienced professionals working in the industry regarding the criticality of the barriers 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.[79] Questionnaire assessment is mainly considered qualitative because it is a suitable method for gathering and assessing qualitative data. It gives opportunities for exploration and conversation of new themes that arise in the course of data collection. Questionnaire survey gives substantial autonomy to the investigators in pre-arrangement of inquiries. In the below subsections, we describe the process of designing and data gathering.

3.1.1 | Designing an online questionnaire survey

Based on the findings of the SLR, we designed a questionnaire. The design of a questionnaire survey normally comprises two phases, sampling, and design. Discovering, listing, selecting, and approaching the suitable field s experts to contribute to the questionnaire based survey is known as sampling.[80] 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) Nonmethodical approach.[80] Using the first approach, samples are obtained directly from the population available with the help of certain statistics. While approach B is used, when the entire population is difficult to list.[80] We have used approach B because in our survey it was impossible to list all the software houses involved in outsourcing. Other scholars like Khan et al,[1] Cox et al,[81] and Niazi et al[82] 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, ie, demography, a list of 27 barriers to be evaluated by seven points Likert scale, and submission instruction.

Question type

We have incorporated a mixture of open and close-ended questions.

Evaluation scale for the major survey

Seven points Likert scale, ie, 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 to mention barriers which are not listed were also provided.

Testing

The questionnaire design was piloted through six members of our laboratory and necessary changes were made accordingly.

3.1.2 | Data Gathering

Survey inquiry is deliberated a suitable method of gathering tacit qualitative and quantitative data.[79] The questions of the questionnaire are of two types. Open-ended also called subjective and close-ended also called objective. The subjective questions allow a variety of answers from the respondents 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 respondent to give her/his own view regarding a specific question.[79,80]

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 which could be taken to ensure privacy and confidentiality. The outcomes of the empirical survey are presented in Table 4.

Phase 3. (Expert panel review): The 3rd phase of data collection was obtaining the structural association amongst the barriers through expert panel review. ISM was used to draw the perceptions of experts concerning the relative inter-relationships amongst these barriers to identify the direct and indirect associations amongst the barriers. For this purpose, we identified a panel of 10 experts from the respondents of the survey, based on their expertise and experience in outsourcing. Only barriers to which the majority of the experts agreed in the survey were considered for further analysis through ISM technique. To develop pair-wise associations amongst the barriers, experts were asked to give their opinions based on four options (achieved by, leads to, bidirectional, no relation), across the rows and columns of the table listing barriers. The result was then translated based on Table 2

3.2 | Interpretive structural modelling (ISM)

ISM approach is an application of MCDM that explains the complex pattern of association s by incorporating simple notations of graph theory.[36-38] It is based on an interpretive methodology (created based on the opinions of the industrial and academic experts) for creating the relative associations amongst the identified barriers that may be related or isolated and which positively or negatively affect a problem or an issue of interest to the research community.[75-77] It is worth noting that, unlike TOPSIS, AHP, and ANP for establishing the association amongst the listed factors, the ISM approach does not need the dominance level of barriers. This assists in decreasing the expert s prejudice and subjectivity while developing the association amongst various predictors and ultimately refining the reliability of the model. It offers a clear understanding of the model variables and assists experts to detect structure within the identified variables.[75-77]

A complete flow diagram of ISM and MICMAC-based analysis methodology is illustrated in Figure 2. With reference to the studies[50,53,57-60,62,63,67-69,71,72] listed in Table 1, the steps involved in the ISM methodology are given below:

Step 1. Identification of barriers through SLR and survey

To identify variables related to the issues or problems under consideration, in the first step, various barriers to SOP formation were identified via SLR and empirical survey.

Step 2. Development of structural self-interaction matrix (SSIM)

TABLE 2 Linguistic terms for associating barriers

Linguistic Terms	Meaning	Corresponding Symbols
Achieved by	Barrier ***a*** will help to achieve barrier	V
Leads to	Barrier ***a*** will lead to barrier	A
Bidirectional	Barrier ***a*** and will achieve each other	X
No relation	Barrier ***a*** and have no relation to achieve each other	O

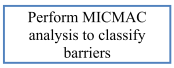

Perform MICMAC analysis to classify barriers

TABLE 4 Summary of the barriers from experts perspective

		Experts' Observation (n = 50)											
		Positive (P)					Neutral (N)		Negative (N)				
Code	Barriers	EA	MA	SA	X	%age	Y	%age	SDA	MDA	EDA	Z	%age
B1	Vendor opportunism and low mutual trust	08	15	17	40	80%	04	08%	03	02	01	06	12%
B2	Communication gap and poor client-vendor coordination	27	14	03	44	88%	03	6%	03	0	0	03	06%
B3	Relational risk and poor relationship management	27	15	01	43	86%	04	8%	03	0	0	03	06%
B4	Insufficient quality of technical capability	37	04	04	45	90%	05	10%	0	0	0	0	0%
B5	Poor infrastructure	38	04	03	45	90%	05	10%	0	0	0	0	0%
B6	Poor quality of service and lack of comonitoring	38	04	04	46	92%	02	04%	02	0	0	02	4%
B7	Organisational differences	19	15	10	44	88%	01	02%	05	0	0	05	10%
B8	Hidden cost and high anticipated switching cost	15	14	10	39	78%	02	04%	06	02	01	09	18%
B9	Lack of psychological contract and poor contract management	22	17	02	41	82%	04	08%	05	0	0	05	10%
B10	Poor knowledge sharing management and cooperation between partner	14	11	12	37	74%	06	12%	04	03	0	07	14%
B11	Insufficient knowledge of the client activities and lack of domain training	16	14	11	41	82%	04	08%	04	01	0	05	10%
B12	Volatile requirement and poor requirement change control	18	10	08	36	72%	06	12%	07	01	0	08	16%
B13	Strategic inflexibility and ineffective dispute resolution mechanism	6	15	15	36	72%	05	10%	06	02	01	09	18%
B14	Poor estimation and lack of capacity to deliver product under strict time schedules	16	14	13	43	86%	04	08%	03	0	0	03	06%
B15	Geopolitical risk and country instability	23	13	06	42	84%	04	08%	04	0	0	04	08%
B16	Misaligned goal, and power difference	10	11	12	33	66%	11	22%	05	01	0	06	12%
B17	Sign of uncertainty and lack of uncertainty absorption mechanism	12	11	09	32	64%	11	22%	06	01	0	07	14%
B18	High staff turnover and lack of human capital management expertise	13	12	09	34	68%	08	16%	07	01	0	08	16%
B19	Poor project management and lack of comanagement infrastructure	28	12	03	43	86%	03	06%	04	0	0	04	08%
B20	Information leakage and lack of intellectual property right protection	19	16	07	42	84%	04	08%	04	0	0	04	08%
B21	Incompatibility and lack of interfirm adaptation	10	14	10	34	68%	08	16%	08	0	0	08	16%
B22	Vendor financial instability and no relation specific investment	09	12	10	31	62%	08	16%	08	03	0	11	22%
B23	Lack of control over the project	20	13	04	37	74%	03	06%	08	02	0	10	20%
B24	Problems stemming from organisational restructuring	11	14	09	34	68%	08	16%	06	02	0	08	16%
B25	Poor leadership and lack of top executive support	09	16	10	35	70%	08	16%	07	0	0	07	14%
B26	Weak social capital and lack of social networking	06	13	11	30	60%	09	18%	07	02	0	09	18%
B27	Client concentration and other client specific risks	03	08	08	19	38%	17	34%	04	05	06	15	30%

Abbreviations: EA (Extremely Agree), MA (Moderately Agree), SA (Slightly Agree), SDA (Slightly Disagree), MDA (Moderately Disagree), and EDA (Extremely Disagree).

To become aware of the contextual associations amongst the barriers, in the second step, an initial pair-wise association amongst the identified barriers was developed in the form of structural self-interaction matrix (SSIM). SSIM was developed based on the experts evaluations using the scale of Table 2 for translation.

Step 3. Development of initial reachability matrix (RM) from SSIM

The SSIM shows the direct associations amongst barriers while the RM shows both the direct and indirect relationships. Based on the SSIM, two steps were executed to develop the RM. To identify the direct relationships amongst barriers, an initial RM was obtained from the SSIM of Step 2.

Step 4. Obtain final RM from initial RM by including transitivity

The initial RM based on SSIM only shows the direct relationships amongst variables lacking the indirect associations; it is indispensable to identify indirect associations amongst barriers by checking transitivity. Therefore, in the fourth step from the initial RM, final RM was obtained by

identifying transitivity through power iteration analysis. According to Shen et al,[67] if ***R*** represents final RM, and ***R*** represents initial RM, then ***R*** can be obtained through Equation (1)

$$R_f = R_i^k = R_i^{k+1} \tag{1}$$

Step 5. Partition of RM into different levels

To establish the hierarchy structure and to identify various levels in the hierarchy, from the final RM of step 4, the reachability set ***R***, antecedent ***A,*** *and* intersection set R ∩ A for each barrier will be obtained.

Based on set ***R, A,*** and R ∩ A, level partitions will be performed. To determine the level of each barrier, set ***R*** was compared with the intersection set R ∩ A.[67] Barriers for which R = R ∩ A will secure level 1. The variable which was marked will be discarded from the rest, and the same procedure will be repeated until all barriers were marked.

Step 6. Formation of canonical matrix and development of digraph

In this step, from the final RM of associations amongst the barriers, a canonical matrix is developed. Canonical matrix is used to draw a digraph (directed graph). A digraph is developed based on the 1 s in the canonical matrix.

Step 7. MICMAC analysis techniques

To address dispersion of the barriers, MICMAC also called cross-impact matrix multiplication applied to the classification analysis technique[72] used in the last step to categorise the barriers into four categories based on the dependence power and driving power of each barrier.

4 | RESULTS AND ANALYSIS

In this section, we present the outcomes of SLR and empirical survey.

4.1 | Barriers identified via SLR (RQ1)

After getting the final sample, we extracted the data from these papers; at the last stage of the data extraction phase, we extracted a list of quotes from the final sample of 106 articles. Each primary investigator in discussion with the secondary investigators (co-authors) went through these quotes to classify these barriers into different groups. A qualitative coding approach based on grounded theory[83] was adopted to reach an initial category of barriers, and as a result, a list of 34 groups was formed. These groups were further analysed by the secondary reviewers, and some groups were combined. Finally, we came up with a list of 27 barriers as illustrated 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 (B1)" is the top reported barrier in our study with 82% citation in our final SLR sample. Opportunism refers to "lack of condor or honesty in trading, to include self-interest pursuing with guile".[84] "Communication gap and poor client-vendor coordination (B1, 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 organisational 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".[85] Language and culture barriers are well-known "communication barriers".[85]

In our SLR, 74% of the authors have stated "relational risk and poor relationship management (B3)" 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.[86] 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 with the agreed deadlines.[87,88] Poor relationship management may be due to lack of personnel with the capability to manage a partnership.

Likewise, it was found that 73% of the included articles in our SLR study have declared "insufficient quality of technical capability (B4)" and "poor technological infrastructure (B5)" 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 the organisation s out-dated technology, lack of legacy and new system integration, and reluctance to use new technology.[30,31]

The sixth high quoted barrier (71% occurrence) in our SLR is "poor quality of service and lack of co-monitoring (B6)." Monitoring and control are "the process of abiding by policies, standards, goals, or quality levels".[85] Without effective monitoring in outsourcing, vendors may behave opportunistically and make choices, which will increase their benefits at the cost of clients.[89]

Likewise, "organisational differences (B7)" is mentioned by 69% of the SLR sample to be an important barrier. According to Beulen,[12] Global Sourcing Partnership (GSP) possesses some specific complications like culture and language differences, time zone, and work dispersion. According to Nguyen-Duc,[90] 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 organisation involved.

"Hidden cost and high anticipated switching (B8)" is claimed by sixty-four percent of the authors in our SLR as an opposing barrier for SOP formation. "Switching costs" is an important barrier for managerial decisions to continue or discontinue an outsourcing association.[91] "Hidden costs" are those costs that are not estimated or foreseen in the various phases of strategic decision making.[92]

Similarly, 52% of the included research papers reported "lack of psychological contract and poor contract management (B9)" as the main barrier. By "poor contract management," we mean rigid, fixed prices, inadequate, or incomplete contracting. In view of Abdullah and Verner,[30] a contract will be incomplete, if it neglects post outsourcing phase and fails to specify appropriate measure like nonperformance penalty. Wei et al[93]

If a barrier is answered as agreed in the questionnaire with a percentage of more than or equal to 50% then that barrier will be considered as a key barrier in this exploratory study.

The same criterion was also incorporated in our previous studies.[1,95-98] A study was conducted by Niazi et al,[99] 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.[2,82,90]

However, SDO practitioners and researchers may also delineate their own criterion to plump the criticality of the identified barriers. Based on this criterion, we drop on barrier "client concentration and other client specific risks" form further analysis via ISM and MICMAC, as discussed in the subsequent sections.

4.3 | Interpretive structural modelling (ISM) analysis (RQ3)

In this section, the outcomes related to RQ3 are presented. In the first step of our methodology, 27 barriers were identified from a sample of 106 papers through SLR. Before answering RQ3, we had validated the barriers identified through SLR using a questionnaire survey. Only 26 barriers to which the majority of the experts agreed were considered for further analysis through ISM technique. For ISM study, from the participants of the major survey, we selected a panel of 10 experts based on their experiences. To reduced single perspective bias the experts were chosen both from academia and industry. To develop a pair-wise association amongst identified 26 barriers as shown in Table 4. The experts were asked to give their opinions based on four options (achieved by, leads to, bidirectional, no relation) across the row and column.

4.3.1 | Development of structural self-interaction matrix (SSIM)

In.362

approach that if a barrier "X" is associated to "Y" and "Y" is associated to "Z" then "X" must be associated to "Z." The final RM is obtained from the initial RM by including transitivity manually.

Table 5 represents the final RM where 1v means forward transitivity while 1a means backward transitivity. Forward transitivity is obtained through symbol V while backward transitivity is obtained through symbol A. Table 5 also contains the driving (represented by row) and dependence power (represented by column) of each barrier along with its ranks. The calculation of driving and dependence power of barriers is based on the final RM and is defined as follow.

Driving power of barriers

To obtain the driving power of barriers, we count the number of 1 s across the rows in the final RM.

Dependence power of barriers

To obtain the dependence power of barriers, we count the number of 1 s across the columns in the final RM.

Ranks of barriers

We ranked the barriers based on the driving and dependence power such that an influential with highest driving and dependence power were assigned high rank.

The final RM is further used for level partitioning of the barriers for building ISM hierarchical structure, while both driving and dependence power of the barrier is used to help in conducting the MICMAC analysis.

4.3.3 | Partition of final RM into different levels

From the final RM as illustrated in Table 5, the reachability set *R* and antecedent *A* for each barrier is obtained. The final RM is partition into various levels. The procedure is as follow:

Reachability set

Set ***R*** of barriers ***a*** will contain ***a*** itself and all other barriers that help to achieve them in the row while

Antecedent set

Set ***A*** of barriers ***a*** will contain ***a*** itself and all other barriers that help to achieve them in the column.

R ∩ A is obtained for all barriers which give a set of barriers common in both ***R*** and ***A***.

Top level node in the hierarchy

A barrier having both reachability set ***R*** and intersection set R ∩ A the same ie, R = R ∩ A will be assign level 1. A top level barrier is a barrier achieved with the help of all other barriers, but it does not help to achieve any barrier. The top level barrier can be more than one influencing each other at the same level. Once top level barriers were marked, in the next step they were separated from the leftover barriers. The top level barriers are shown in Table 6.

The same procedure was repeated until all possible levels were marked. In the present study, the process was reached up to 11 iterations. Level wise results were summarised in Table 6. These levels were further used to obtain conical matrix and digraph and to structure the final ISM hierarchy. From Table 6, it is observed that both "vendor opportunism and low mutual trust" (B1) and "relational risk and poor relationship management" (B3) are marked for level-I during the first iteration. Poor quality of service and lack of comonitoring (B6), hidden cost, and high anticipated switching cost (B8), and information leakage and lack of intellectual property right protection (B20) are placed at level II of the ISM model. These were marked during second iteration. After finishing third iteration lack of technical capability (B4) and weak social capital and lack of social networking (B26) were placed at III levels. During the fourth iteration, only one barrier B23 (lack of control over the project) was isolated and put at level IV. Similarly, geopolitical risk and country instability (B15) and poor leadership and lack of top executive support (B25) were marked during the last iteration, ie, Iteration 11 and are put at the last level XI, respectively, as shown in Table 6.

4.3.4 | Formation of a conical matrix (CM) and development of digraph

A conical matrix is developed by assembling barriers at the same level across the columns and rows of the final RM. The CM helps to draw the structural model, which is illustrated in Table 7. CM will be used in the generation of the digraph. It is worth noting that in this step transitive links were removed. The initial digraph is produced with transitivity, from which a final digraph can be created by removing the indirect links. A final digraph is shown in Figure 3; this digraph will be finally converted into the ISM based SOPBA framework model, as shown in Figure 4.

TABLE 5 Final reachability matrix of the barriers

Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Driving Power	Ranks
B1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4	23
B2	1	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1_v	1	1	0	1	1	0	1	20	4
B3	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	6	21
B4	1	1	1	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	6	21
B5	1_a	1	1	1	1	1	0	0	0	1	1_v	0	0	1	0	1_v	1_v	0	0	0	1_v	0	1_v	0	0	0	13	16
B6	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	25
B7	1	1	1	1	0	1	1	0	0	1	1_v	0	1	1	1	1_v	1	0	1_v	1_v	1_v	0	1	1	0	1_v	19	7
B8	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	23
B9	1	1_a	1	1	0	1	0	1	1	1	1_v	0	1	1	0	1	1	0	1_v	1	1_v	0	1	0	0	1_v	18	10
B10	1	1	1	1	0	1	0	1	0	1	1	0	0	1	0	1	1	0	1	0	1	0	1	0	0	1_v	15	14
B11	1_a	1	1	1	0	1	1	1	1	0	1	1	0	0	0	1	1	0	1_v	0	1	0	1	0	0	1_v	16	12
B12	1_a	1_a	1	1	0	1	0	1	1	0	1	1	1	0	0	1	1	0	1_v	0	1	0	1	0	0	1_v	16	12
B13	1	0	1	1_a	0	1_a	0	1_a	0	1	0	1	1	0	0	1	0	0	0	0	1	0	1_v	0	0	1	12	18
B14	1_a	0	1	1	0	1	1_a	1	1_a	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1_v	12	18
B15	1	1_a	1	1	0	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	0	1	1	0	1	20	4
B16	1	0	1	1_a	0	1	1	1	0	0	0	0	1	0	0	1	1	0	1_v	0	1	0	1	0	0	1	13	16
B17	1	1_a	1	1	0	1	0	1	0	1_a	1_a	1_a	1	1	0	0	1	0	1	1_v	0	0	1	1_v	0	1_v	17	11
B18	1_a	0	1	1	1	1	1	1	1_a	1	1	1	1_a	1	0	0	1	1	0	1	0	0	1	1	0	1	19	7
B19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1_a	1	1	1	0	0	1	0	0	1	21	3
B20	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	25
B21	1	1_a	1	1	0	1	1	1	1	1_a	1_a	1_a	1_a	1	0	1_a	1	1	1	0	1	0	1	0	0	1	20	4
B22	1	1_a	1	1	1	1	1_a	1_a	1_a	1_a	1	1_a	1_a	1_a	0	1	1_a	1	0	1	0	1	0	0	0	0	19	7
B23	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	10	20
B24	1_a	1_a	1	1	1_a	1	1_a	1_a	1	1	1_a	1	1_a	1	0	1	1	1_a	1	1_a	1	0	1	1	0	1	23	2
B25	1_a	1	1	1	1	1	1_a	1_a	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	25	1
B26	1	0	1	1_a	0	1	1	1_a	1_a	1	1	0	0	1_a	0	1	1	0	0	1	1	0	0	0	0	1	15	15
Dependence power	26	17	26	20	6	22	14	19	14	16	17	13	13	15	2	17	18	7	13	13	14	3	18	7	1	18	369	
Ranks	1	9	1	4	23	3	14	5	14	12	9	17	17	13	25	9	6	21	17	17	14	24	6	21	26	6		

TABLE 6 Final iteration-level partition of barriers

Code	Reachability Set	Antecedent Set	Intersection	Level
B1	{1, 3 10, 16	{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26	{1, 3 10, 16	I
B2	{1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 19, 20, 21, 23, 24, 26	{2, 3, 4, 5, 7, 9, 10, 11, 12, 15, 17, 19, 21, 22, 23, 24, 25	{2, 3, 7, 9, 10, 11, 12, 17,{2, 3, 5, 7, 9, {1, 12,	

4.3.5 | Formation of the ISM-based structural model

ISM for barriers was obtained from the developed digraph in Figure 3, by replacing the nodes of the graph with a verbal statement in the re
tive barrier. The structural model displays the relationships amongst the barriers. If the relation between barriers and
covered by an arrow pointing from ***a*** to , respectively.

TABLE 7 Conical matrix (CM)

Code	1	3	6	8	20	4	26	23	11	13	16	12	14	17	10	2	7	9	5	18	19	22	21	24	15	25	Driving Power
B1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
B3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
B6	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
B8	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
B20	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
B4	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
B26	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
B23	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
B11	0	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
B13	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
B16	1	1	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
B12	0	1	1	1	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
B14	0	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	8
B17	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	13
B10	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	13
B2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	16
B7	1	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	14
B9	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	16
B5	0	1	1	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	7
B18	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	15
B19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	21
B22	1	1	1	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	10
B21	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	0	20
B24	0	1	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0	0	17
B15	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1	0	1	1	0	1	1	0	1	1	1	0	19
B25	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	22
Dependence Power	19	25	21	14	10	18	15	16	15	11	12	11	12	11	11	8	6	6	5	7	5	2	4	3	1	1	269

The developed ISM model was checked and reviewed for any possible conceptual inconsistencies. The result indicates that these barriers are organised into 11 levels in the hierarchy model. Both "vendor opportunism and low mutual trust" (B1) and "relational risk and poor relationship management" (B3) is the target of the hierarchical system, and is located at the top level, which directly depends on poor quality of service and lack of comonitoring (B6), hidden cost and high anticipated switching cost (B8), and information leakage and lack of intellectual property right protection (B20). The three barriers at level II are achieved by the lower-level barriers lack of technical capability (B4) and weak social capital and lack of social networking (B26). "Lack of control over the project" (B23) is the only barriers at the fourth level. It directly depends on "insufficient knowledge of the client activities and lack of domain training" (B11), "strategic inflexibility and ineffective dispute resolution mechanism" (B13), and misaligned goal, and power difference (B16). Level II contains only two barriers, ie, lack of technical capability (B04) and weak social capital and lack of social networking (B26). Both barriers of level III can be achieved by the single barrier lack of control over the project (B23) at Level IV. Figure 4 shows the hierarchical distribution of barriers into different levels.

4.4 | MICMAC analysis techniques (RQ4)

MICMAC technique[72] was used to categorise the barriers into four categories. The categories are explained as follow:

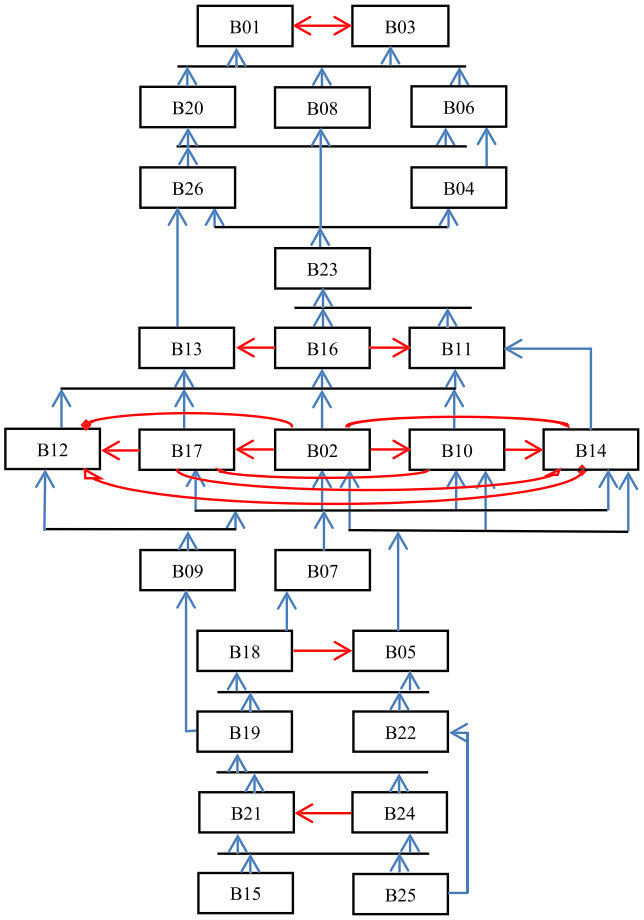


FIGURE 3 Digraph model of barriers to SOP formation

Autonomous

Barriers having both driving and dependence power as weak will be considered autonomous barriers. These are comparatively less associated to the rest. These barriers are illustrated in Quadrant-I.

Dependent

Barriers having strong dependence power but weak driving power were considered dependent barriers. These barriers are illustrated in Quadrant-II

Linkage

Barriers having both driving and dependence power as strong were considered linkage barriers. Such barriers are affected by lower level barriers in the model and in reverse; they influence the significant amount of other barriers in the model. These barriers are illustrated in Quadrant-III.

Independent

The barriers having strong driving power but weak dependence power will be considered independent barriers. These barriers are illustrated in Quadrant-IV. Figure 5 illustrates the clusters power matrix of the barriers based on the dependence and driving power. The final iteration level of each barrier is given in Table 6.

In the above figure, the red colour arrow represents the association at the same level while the sky colour arrow represent the association with others levels

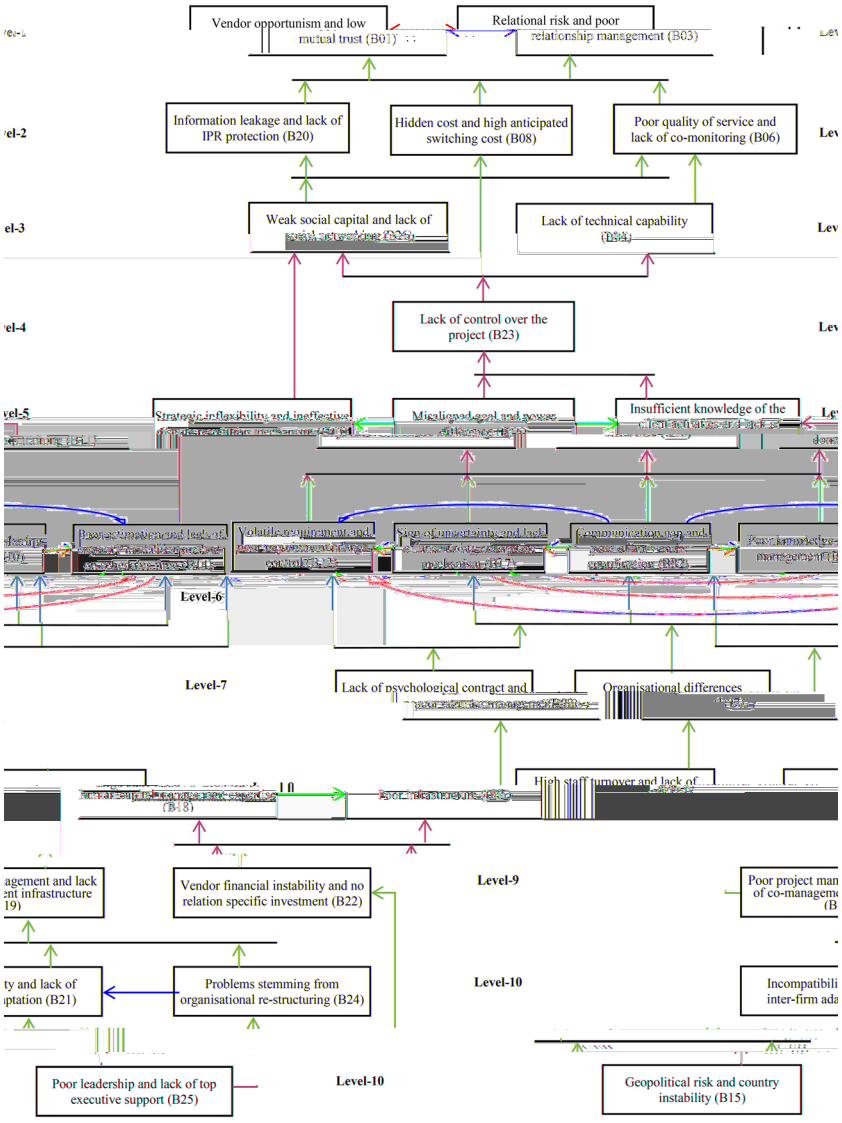


FIGURE 4 ISM-based software outsourcing partnership barriers association (SOPBA) model

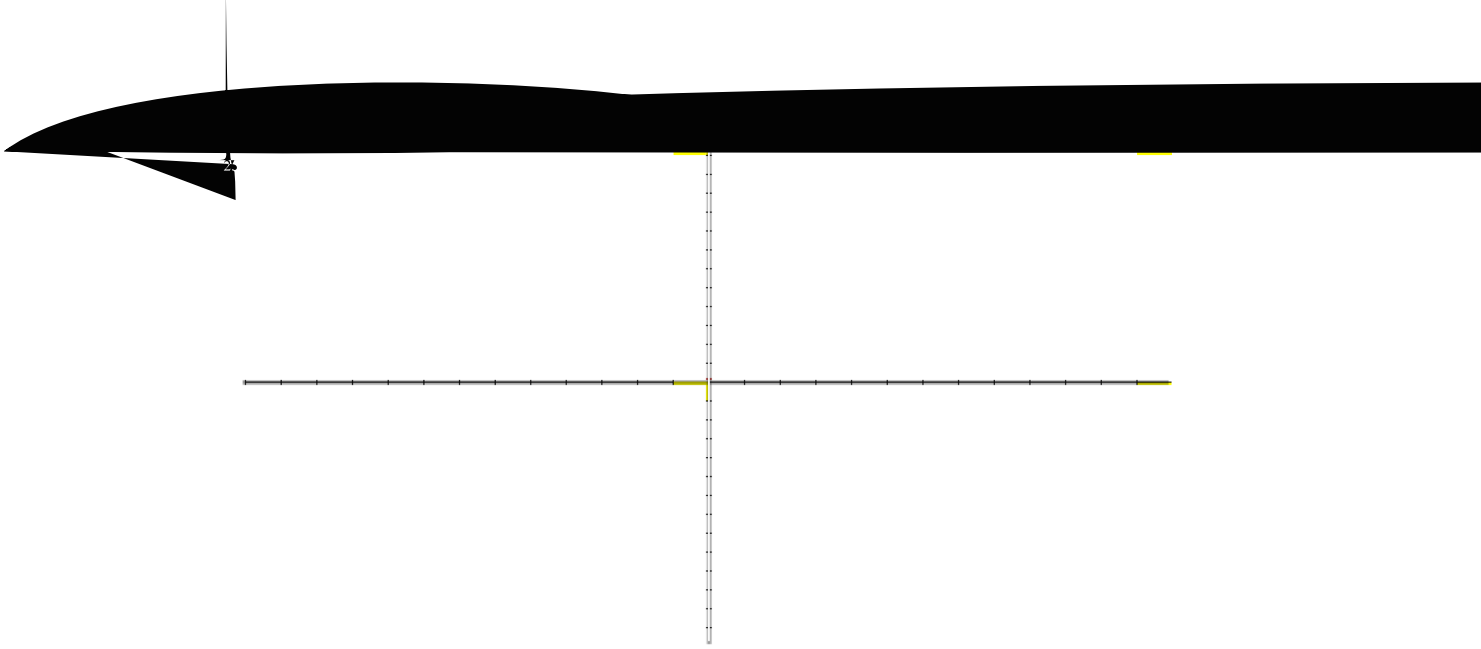
5 | SUMMARY AND DISCUSSIONS

In this paper, an attempt has been made to discover different barriers connected to SOP formation. Limited work has been done on the identification of barriers to SOP formation, and no article can be found on the structured association amongst the barriers in the context of SOP. In this study, we have identified 27 barriers in total, for SOP stakeholders through SLR. These barriers may restrict outsourcing clients from renovation or upgradation of their existing contractual outsourcing associations into an outsourcing partnership with vendor organisations. Emphasis is given to key barriers, and those barriers are included in the structured hierarchical model whom significance are strongly agreed by experts in the empirical survey. Therefore, 26 barriers were put forward for further analysis of the interdependence through ISM and MICMAC techniques. Our research aims to provide SOP vendors with clear guidance that can support them to design and implement effective outsourcing partnership ventures. This research recommends that vendors should focus on all of the reported barriers as mentioned in Table 3 specifically those with high dependence and low driving power in the final RM (Table 5). Barriers signify some of the critical areas where management should focus their attentions to better design SOP initiatives.

To answer RQ1, Table 3 presents 27 barriers. These barriers play a negative role in the renovation or promotion of existing outsourcing relationship to a partnership.

To address RQ2, the experts agree to all the identified barriers except the last one B27 (client concentration) for which the positive percentage was less than 50%. Therefore, for further analysis through ISM 26 barriers were left.

In response to RQ3, the contextual relationship amongst the barriers is modelled by developing the ISM model as shown in Figure 4. The ISM model mixes the SOP barriers in a hierarchy of 11 distinct levels with the horizontal and vertical arrow showing the interrelationship amongst barriers. The top barriers are those barriers that have high dependence power but low driving power in the canonical matrix (Table 7). It means these



barriers are affected by most of the barriers, but it does not affect any barrier except those at the same level. On the other hand, the bottom barriers have high driving power and low dependence power in the canonical matrix (Table 7). It means these barriers help in achieving theoretically all barriers, but it does not depend on any barrier except those at the same level.

For instance, it can be seen from Figure 4, that at level XI (from bottom) barriers B15 ("Geopolitical risk and country instability") and B25 (poor leadership and lack of top executive support) are shown. These barriers have high driving power and dependence power of only 1 in the canonical matrix (Table 7). It means these barriers help in achieving theoretically all barriers, but it does not depend on any barrier. It means country instability and poor leadership will affect most of the barriers. If it is not addressed, it is difficult to address all those who depend on it. Mukherjee et al[100] reports offshoring gives birth to this unique challenge due to geographic distance and political conditions of the partner location.

Level X also has two barriers B21 ("Incompatibility and lack of interfirm adaptation") and B24 ("Problems stemming from organisational re-structuring"). These barriers have dependence power of only 2 and 3, respectively. For instance, B21 is dependent on B15, B21, and B24, while B24 only depends on B15 and B25. It means most of the issue arising from organisational re-structuring will be connected to country instability and poor leadership. Additionally, firms will not adapt to each other unless the partner country is not stable or the partner lacks strong leadership.

Level IX consists of two barriers B19 (poor project management and lack of comanagement infrastructure) and B22 (vendor financial instability and no relation specific investment). These two barriers have dependence power of 5 and 2, respectively. B19 depends on B15, B21, B24, and B25, respectively, while B22 only depends on B25. Vendor financial instability and no relation specific investment can only be affected by poor leadership. Mehta[101] reports that "leadership and team management" requires proper experience to manage and lead teams; sometimes, they adopted improper approaches to motivate their team members. Therefore, poor leadership will result in poor project management. Further, poor leaders from client organisation fail to motivate vendors to invest.

Poor project management and lack of comanagement infrastructure may be due to country instability, poor leadership, issues of organisational restructuring, or incompatibility and lack of interfirm adaptation. Level VIII also composed of two barrier B5 (poor infrastructure) and B18 (high staff turnover and lack of human capital management expertise). B5 has a dependence power of just 5, while B18 dependence power is seven. Poor infrastructure (B5) may be due to:

i. Vendor financial instability and no relation specific investment (B22)
ii. Poor project management and lack of co-management infrastructure (B19)
iii. High staff turnover and lack of human capital management expertise (B18) or
iv. Poor leadership and lack of top executive support

Level VII contains B7 (organisational differences) and B9 (poor contract management) both have six dependence power. It means that it helps to achieve their respective six barriers. Level VI contains five barriers B2, B10, B12, B14, and B17. All these barriers have balance dependence and driving power. It means these are both diver and dependent. Level V contains three barriers namely B11, B13, and B16. These all achieve B23 at level IV which further drive B4 and B26 at level III. Level II contains B6, B8, and B20 while level I is the top level which contains barrier B1 and B3. They have a driving power of 1 and 2, respectively. These barriers have the lowest driving power while highest dependence power. For instance, B3 (relational risk and poor relationship management) is dependent on all other barriers, while it only can affect B1 (vendor opportunism and low mutual trust).

- According to Lioliou and Zimmermann,[84] 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. Maintaining strong social capital and mutual trust will discourage vendor opportunism.[82]
- Ajitkumar et al[86] state that relational risks obstruct client-vendor collaboration and thus inhibiting them from performing their responsibilities efficiently and effectively for the attainment of mutual goals. 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.[87,88]

For RQ4, dispersion of the barriers is addressed by performing MICMAC analysis. For the purpose of MICMAC analysis, the barriers are dis-

20 countries would agree with us, however, we believe that they provide a descriptive sample. In empirical survey-based research, it is hard to obtain a fully representative sample and to deal with them in an entirely objective fashion.[103] To overcome these limitations, only those participants were included who are involved in outsourcing. The claim/relevant expertise of the participants were verified by inculcating some open-ended questions in the questionnaire which were 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 to have a significant inter-relation for renewal or upgradation may not, in fact, be significant at all. However, similar to others opinion-based empirical research studies,[33,98,99] 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.

7 | CONCLUSION AND FUTURE WORK

The reported work contributes in the formation of a framework for modelling structural association amongst the barriers by employing a qualitative methodology for identifying the contextual inter-relationship amongst various barriers, which collectively restrict the SDO vendors from renewing or upgrading their relationships with their overseas clients. Like other researchers,[37,48,50-69,71,72] in the published literature on the association between qualitative barriers, the present study tries to fill some of the research gaps and propose a conceptual framework. This work will not only benefit the outsourcing stakeholders in understanding the indirect effects of barriers but at the same time will help them to design solu-

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APPENDIX A

TABLE 8 Structural self-interaction (SSIM) matrix of the barriers

Code	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01
B01	A	O	O	A	A	A	A	A	O	A	X	A	O	A	O	O	X	A	A	A	A	O	A	X	A	X
B02	V	A	V	X	O	V	V	A	O	V	V	O	V	V	V	X	X	V	V	X	V	A	A	X	X	
B03	A	A	A	A	X	A	A	A	A	A	X	A	A	A	A	A	A	A	A	X	A	A	A	X		
B04	O	A	A	A	A	A	O	A	A	A	O	A	X	O	A	A	A	A	O	A	V	A	X			
B05	O	A	O	O	A	O	O	A	A	O	O	O	V	O	O	O	V	O	O	O	V	X				
B06	A	A	A	A	A	A	O	A	A	A	A	A	A	O	A	A	A	A	O	A	X					
B07	A	O	V	V	O	A	O	A	A	V	A	X	V	V	O	A	V	O	O	X						
B08	O	O	O	A	O	A	O	A	A	A	A	A	A	O	A	A	A	X	X							
B09	O	A	A	V	O	A	V	A	O	V	V	A	V	V	A	A	V	X								
B10	A	A	A	V	O	V	O	X	A	V	V	A	V	A	O	V	X									
B11	A	A	O	V	A	V	O	A	A	V	V	A	A	O	X	X										
B12	O	A	A	V	O	V	O	A	A	V	V	A	A	X	X											
B13	V	A	O	O	O	V	O	A	O	A	X	O	O	X												
B14	O	A	A	V	O	A	O	A	A	A	O	O	X													
B15	V	O	O	V	O	V	V	V	V	V	O	X														
B16	X	A	A	V	A	V	O	A	O	V	X															
B17	A	A	A	X	O	A	O	V	A	X																
B18	V	A	V	V	A	A	V	A	X																	
B19	V	A	A	V	O	A	V	X																		
B20	A	A	O	A	A	O	X																			
B21	X	A	A	V	O	X																				
B22	O	A	O	O	X																					
B23	V	A	A	X																						
B24	V	A	X																							
B25	V	X																								
B26	X																									

APPENDIX B

TABLE 9 Initial reachability matrix of the barriers

Code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
B01	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
B02	1	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	0	1	1	0	1
B03	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
B04	1	1	1	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
B05	0	1	1	1	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
B06	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B07	1	1	1	1	0	1	1	0	0	1	0	0	1	1	1	0	1	0	0	0	0	0	1	1	0	0
B08	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B09	1	0	1	1	0	1	0	1	1	1	0	0	1	1	0	1	1	0	0	1	0	0	1	0	0	0
B10	1	1	1	1	0	1	0	1	0	1	1	0	0	1	0	1	1	0	1	0	1	0	1	0	0	0
B11	0	1	1	1	0	1	1	1	1	0	1	1	0	0	0	1	1	0	0	0	1	0	1	0	0	0
B12	0	0	1	1	0	1	0	1	1	0	1	1	1	0	0	1	1	0	0	0	1	0	1	0	0	0
B13	1	0	1	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	1
B14	0	0	1	1	0	1	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0
B15	1	0	1	1	0	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	0	1	0	0	1
B16	1	0	1	0	0	1	1	1	0	0	0	0	1	0	0	1	1	0	0	0	1	0	1	0	0	1
B17	1	0	1	1	0	1	0	1	0	0	0	0	1	1	0	0	1	0	1	0	0	0	1	0	0	0
B18	0	0	1	1	1	1	1	1	0	1	1	1	0	1	0	0	1	1	0	1	0	0	1	1	0	1
B19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0	0	1	0	0	1
B20	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
B21	1	0	1	1	0	1	1	1	1	0	0	0	0	1	0	0	1	1	1	0	1	0	1	0	0	1
B22	1	0	1	1	1	1	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0
B23	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1
B24	0	0	1	1	0	1	0	0	1	1	0	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1
B25	0	1	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
B26	1	0	1	0	0	1	1	0	0	1	1	0	0	0	0	1	1	0	0	1	1	0	0	0	0	1

APPENDIX C

TABLE 10 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

(Continues)

TABLE 10 (Continued)

Respondent ID	Position in the Company	Classification	Respondent Job Location	Experience in Years	Classification	Company Scope	Company Size
#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