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Investigation of Challenges in Complex Outsourcing Relationships: An Empirical Study

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ABSTRACT

Complex outsourcing contracts offer numerous advantages, such as improving cost predictability, achieving cost savings, and increasing scalability and flexibility when needed. However, managing complex outsourcing arrangements often involves interactions among multiple stakeholders from various backgrounds and cultures, which can be considerably more challenging than typical outsourcing. This research aims to validate and investigate the challenges identified via a systematic literature review and expand upon these findings through empirical or statistical means. To do so, we conducted a questionnaire survey involving 60 professionals from 25 different countries worldwide. To assess the significance of each challenge, participants were asked to rank each challenge on a five-point scale. Furthermore, we analyzed these challenges across different continents, organization(s) size, organization(s) scope, SPI certification(s), experience of staff, and employee's job statuses using various statistical techniques. The study's findings underscore the critical nature of these challenges within the context of complex outsourcing, highlighting the need for organization(s) to carefully address them in order to foster successful relationships.

Keywords: Software engineering, SLR, survey, software outsourcing, relationships management.

Introduction

At present, information technology is experiencing a period of significant advancement. Therefore, there is a considerable demand for the outsourcing of IT services to enhance product quality and stay abreast of the expanding business landscape [1].

Outsourcing involves transferring the ongoing management responsibilities for a client's operations to a third party, often referred to as a vendor or provider, who executes IT

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services according to a contract or service level agreement [2]. The practice of outsourcing has evolved rapidly and established itself as a legitimate academic field. Notable areas of interest in the literature include outsourcing decision-making, methodologies, and the challenges encountered in outsourcing [3].

Outsourcing offers a range of benefits, including profit maximization, cost reduction, enhanced productivity, adaptability to changing service needs, improved quality, reallocation of company resources to core competencies, increased customer satisfaction, continuity and risk management, accelerated time to market, access to skilled resources, flexibility to focus on core areas, and the provision of quicker and better services [4, 5].

Proponents of IT outsourcing stress the importance of maintaining outsourced relationships. These relationships are characterized by long-term commitment, shared risks and benefits, reciprocal cooperation, and attributes consistent with participatory decision-making concepts and theories. Surprisingly, only a limited number of scholars have explored the client-supplier IT outsourcing relationship, despite the considerable attention given to IT outsourcing interactions in the literature [6].

Contemporary business practices demand cross-corporate collaboration. These client-vendor relationships often extend beyond the initial contractual boundaries. In a joint venture, each partner shares equally in the benefits and drawbacks, as well as the costs and workload. Collaboration between and within organizations enhances their competitive capabilities. Long-term professional partnerships are built on the principles of mutual trust, mutual reliance, and a win-win mindset between partners. Businesses promote collaboration to reduce the costs associated with acquiring the knowledge, skills, and abilities needed for efficient and effective operations [7].

IT outsourcing contracts commonly include provisions for teamwork, virtual interaction, and the demands of increasingly complex systems. Trust is a crucial factor in determining the success of virtual collaboration. Continual managerial effort and focus are vital for maintaining strong relationships, as they are strategic assets [8].

Several factors, including project size, duration, and, most importantly, contract design and management among multiple stakeholders, influence the success or failure of an outsourcing project. Therefore, additional research is required to comprehend how various outsourced components interact and the additional effects these dynamics have on various organizational outcomes [9].

The nature of client-vendor relationships has evolved through different stages as outsourcing has advanced. These stages include dyadic outsourcing relationships, multivendor outsourcing relationships, co-sourcing outsourcing relationships, and complex outsourcing relationships, as succinctly described in [10].

This research particularly focuses on complex outsourcing relationships, which are intricate due to the involvement of numerous stakeholders on both the client and vendor sides. Outsourcing is heavily reliant on strong working relationships and well-crafted contracts. However, the literature lacks comprehensive guidance [11] in this area, especially in the context of complex outsourcing relationships (COR). With the proliferation of multiple actors connected through a contract, such as a client and one or more vendors, each with distinct characteristics, outsourcing has become more complex and diversified [12]. Furthermore, complex outsourcing is considerably more challenging to manage than standard outsourcing, as it often necessitates interactions among numerous stakeholders from different geographic locations and cultural backgrounds.

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Complex outsourcing, when compared to other types of outsourcing, is exceptionally difficult because it requires various control and coordination mechanisms for project management, which proportionally increases the risk of project failure [13].

This paper aims to investigate the challenges associated with complex outsourcing relationships, taking into account the previously discussed factors and insights.

This document represents an updated and substantially expanded version of our prior work, where we delved into the results of a Systematic Literature Review (SLR) concerning the challenges faced by stakeholders in complex outsourcing relationships. In SLR [26], we identified 11 challenges and 67 practices aimed at addressing these challenges within complex outsourcing relationships. In this paper, we have taken each of these challenges and subjected them to quantitative analysis, providing a comprehensive explanation of the research methodology employed. Furthermore, we have conducted a comparative analysis of these challenges across various factors, including different continents, organization(s) size and organization(s) scope, SPI certification(s), experience of organization's staff, and employment status, utilizing statistical techniques. Our overarching research objective is to provide software development outsourcing professionals with a valuable body of knowledge about the key challenges in managing the complex outsourcing relationships.

While conducting the questionnaire survey, we have the following objectives in mind:

To ensure the existence and criticality of the identified challenges from the industry practitioners

To identify variances, if any, based on the varying continent's dataTo see the implications of varying size of an organization on the identified results

To see the implications of varying scope of an organization on the identified results

To see whether an organization's certification brings impacts on the results

To see an organization's employee experience impacts on results

To see an organization's employee status impacts on results

In such context, we have formulated the following research questions at this stage as:

RQ1. Do organizations that participate in complex outsourcing relationships experience the 11 challenges?

RQ2. Do the identified challenges vary across different continents?

RQ3. How are these challenges relating to the organization's size?

RQ4. Are the identified challenges produce different results with organization's scope?

RQ5. Are SPI-certification of organization(s) produce difference results?

RQ6 Do the identified challenges vary with expert's experience level?

RQ7. Do the identified challenges vary with different expert's groups?

This document is organized as follows: Section II provides the related work. Section III define the research methodology. Section IV provides the study results. Section V presents the research limitations. And Section VI presents the conclusion of the document.

Related work

The authors[14] have introduced a robust architectural framework addressing security and compliance issues, particularly in the context of comprehensive software. The study [15] bridges a gap in software support by identifying software requirements derived from an analysis of the work practices of service providers involved in complex outsourcing

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agreements, and subsequently proposes a software design that aligns with these criteria. While there exist several solutions, focused on COR setups, concentrating on IT infrastructure compliance, they often prove ineffective, wasteful, and impractical. In contrast to typical Information Systems (IS) outsourcing projects, complex IS outsourcing initiatives encompass distinct tasks and stakeholder connections.

In light of the global dispersion of IT services, characterized by intricate inter-organizational relationships and the distribution of decision rights and responsibilities among multiple entities [16], a comprehensive understanding of governance procedures is imperative. The study [17] establish a theoretical framework to elucidate various outsourcing relationships and provide insights into why client companies seeking IT services might prefer more complex or collaborative outsourcing arrangements over dyadic interactions. Additionally, they anticipate a growing prevalence of COR relationships in the future.

To assess incentive schemes and draft outsourcing contracts, mutually beneficial to both outsourcers and vendors within COR, the study [18] present a methodology and decision-making approach. Managing complex outsourcing contracts [19] is challenging in its own right, and this challenge escalates significantly in the presence of factors like time zone differences, language barriers, geographical distances, infrequent face-to-face meetings, and diversity, which are common aspects of offshore deals.

The lifecycle model [20] has been effectively utilized by businesses, frequently engaged in complex outsourcing agreements. Many organizations wrestle with the effective management of one or more intricate outsourcing agreements while striving to create value and mitigate risks [21].

The study [22] examines the importance of trust in intricate contractual and interpersonal arrangements that underpin global outsourcing, along with the challenging techniques for conflict resolution that can be employed to rebuild trust.

The aim of authors [23] was to comprehend what an Indian supplier deems crucial in managing large and complex outsourcing agreements, specifically how mutually beneficial and long-term partnerships are formed and sustained with European clients.

The study [24] seeks to offer a comprehensive understanding of managing complex IT-outsourcing agreements by providing a descriptive framework encompassing critical governance elements. The study's conclusions and the framework itself shed light on the numerous intricate issues that arise during the management of complex IT outsourcing agreements.

Research methodology

This paper represents a crucial component of an extensive research project. In the initial phase, we primarily utilized a Systematic Literature Review (SLR) [26] as our methodology. The SLR was carried out in three phases. Initially, we have organized it and created a protocol for carrying it out. We employed the snowballing technique, the PICO criterion, and the creation of three strings to support libraries such as Google-Scholar, IEEE-Xplore, ACM, Springer-Link, Wiley, and Science-Direct when building the protocol. Crucially, at this point, we have meticulously created both the initial (inclusion and exclusion criteria) and final (quality criterion) criteria. Second, as previously indicated, we have carried out the protocol on the libraries. Lastly, we have put the report.

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From the SLR, we have identified the following 11 challenges, shown in Table 1, as the key challenges in COR.

In this second phase (current phase), we have employed a questionnaire survey to corroborate and expand upon the insights gathered during the SLR. Our objective is to validate the findings of the SLR and to gain deeper insights into these findings, as outlined below. In the third and fourth phase, we developed the model (CORMM) and its validation in the industry was performed via two case studies [38].

Measure development

In the light of objectives of the study and the resources at hand, a survey research design was selected in order to gather information about the elements that software development outsourcing practitioners believe influence the choice of offshore software outsourcing providers [25].

Table1. Challenges from SLR [27] in frequency-based

Challenges	*Paper ID*	*Frequency*	*Percentage*
CH1: Poor Contract Management	1, 3, 5, 6, 7, 25, 8, 11, 12, 13, 14, 16, 18, 21, 23, 25, 29, 31, 34, 35, 36, 38, 40, 41, 45, 47, 50, 51, 52, 53, 57, 59, 62, 63, 65, 67, 68, 72, 76, 77, 84, 85	42	49%
CH2: Risky Contracts	3, 6, 25, 11, 14, 17, 18, 20, 21, 25, 27, 30, 35, 36, 39, 40, 41, 45, 56, 57, 60, 63, 85	23	27%
CH3: Decision Problems	2, 8, 5, 13,14, 28, 31, 33, 35, 40, 42, 54, 58, 61, 66, 71, 73, 76, 83, 84	20	23%
CH4: High Cost	3, 6, 7, 14, 17, 21, 28, 32, 35, 36, 39, 40, 42, 58,51, 66, 76	17	20%
CH5: IT Transitions Difficulties	7, 14, 17, 21, 28, 31, 34, 39, 40, 42, 58	11	12%
CH6: Poor Human Resource Management	8, 11, 53, 59, 72	05	5%
CH7: Security and Compliance Challenges	8, 11, 20	03	3%
CH8: Control and Coordination Challenges	3, 7	02	2%
CH9: Cultural Issues	12, 35	02	2%
CH10: General Management Complexities	35, 72	02	2%
CH11: Modern Technological Challenges	35	01	1%

Survey research can use a variety of data collection techniques, such as interviews and self-administered questionnaires, and is well suited for gathering both quantitative and qualitative data from a sizable number of respondents [25]. A questionnaire was chosen

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as the data collecting instrument in this case because of factors including the requirement to collect data from a wide range of respondents and the accessibility of resources. The questionnaire was developed based on insights from the existing literature and built upon challenges identified in previous research. It included open-ended questions to explore potential success factors beyond those already recognized, aiming to tap into participants' tacit knowledge. The questionnaire was also designed to assess the perceived importance of each success factor, with respondents asked to rate the relative relevance of each item using a scale (e.g., Strongly Agree, Agree, Not-sure, Disagree, Strongly Disagree). The similar approach used by other researchers as well [27].

Before creating the online version, a manual questionnaire was pilot-tested with specialists from SERG at the University of Malakand, Pakistan. Necessary adjustments were made based on their feedback. The questionnaire consisted of five sections:

An introduction to the questionnaire
Practitioner details
Demographic data
Challenges

Additionally, ethical guidelines were communicated to the participants to ensure the protection of their privacy and data confidentiality. Participants were assured that only the research team would have access to their data and that their identities would not be disclosed through data sharing. These measures were taken to maintain the privacy and confidentiality of the participants throughout the research process.

Sample

In this study, a sample is a subset of the larger population under investigation, and it is used to gain insights about the entire population. A sample can be defined as "a group of individuals selected from a broader population for survey purposes, such as the population of professors, students, or presidents" [28].

The target population of our survey was individuals involved in outsourcing, particularly those engaged in COR activities.

It is worth noting that convenience or non-probability sampling approach was employed for the selection of participants and the process involved several steps as follows.

Initially, invitations to participate in the survey were extended to various groups, including LinkedIn, ResearchGate, and other relevant groups.

Upon receiving expressions of interest from 180 potential participants, the researcher sent the questionnaire to 65 practitioners. Following the consensus and final recommendations from experts at SERG (Software Engineering Research Group), the final sample was narrowed down to 60 responses.

The selected participants were from a total of 20 different countries, with the majority hailing from the United States, Europe, and Canada. This diverse representation from various geographic regions contributes to the richness and comprehensiveness of the research findings.

Data analysis method

Frequency analysis is a valuable method for handling descriptive data as it involves grouping scores or values into frequencies. This initial step helps in the organization of both qualitative and quantitative data. By creating frequency tables, one can subsequently

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report the frequencies and percentages of each data variable. Frequency analysis is applicable to numerical data as well as nominal or ordinal data, enabling comparisons within and across various variables. In this research, we primarily employed frequency analysis to analyze the data.

Specifically, we counted the frequency of each challenge throughout the responses to each questionnaire. This allowed us to assess the prominence of each identified challenge. The relative importance of each challenge was determined by comparing the frequency of one challenge to the frequency of other challenges, providing valuable insights into their significance within the context of the research.

Analysis and results

In this section, we will examine the findings of the study results. To facilitate a clear presentation of percentages regarding agreement and disagreement, we categorized the data into two groups: "Strongly Agree" and "Agree" were combined into a single positive percentage, while "Strongly Disagree" and "Disagree" were combined into a single negative percentage. Throughout the process of data collection and analysis using SPSS, we utilized the abbreviations SA (Strongly Agree), A (Agree), SDA (Strongly Disagree), and DA (Disagree) to represent the levels of agreement or disagreement expressed by the respondents.

It is important to note that we considered a challenge as "critical" if it received a rating of 50% or more from the practitioners. This criterion aligns with the approach used by other researchers [29, 30]. However, it's worth mentioning that the software outsourcing community has the flexibility to establish their own criteria for determining the criticality of any specific factor.

To address research question RQ1, Table 2 presents a list of challenges that we validated through the empirical survey. This table provides valuable insights into the challenges perceived by the survey respondents, helping to understand their relative importance within the context of the research.

The data from the table clearly indicates that, out of the total of 60 respondents, the proportion of those who expressed agreement with each issue surpasses the 50% mark.

This clearly signifies that each identified issue is indeed a critical challenge. For example, the agreement percentage for CH1: Control and Coordination Challenges stands at an impressive 96%, while for CH2: Decision Problems, it registers at a substantial 93%, and so forth. Furthermore, the percentage of disagreement, or the proportion of those who disagreed with these challenges, is notably low. Specifically, for CH1: Control and Coordination Challenges, the disagreement percentage is a mere 2%, and for CH2: Decision Problems, it is just 3%.

Furthermore, the findings reveal that the 'CH1: Control and Coordination Challenge' holds the highest positive frequency at 96. To thrive in the competitive market, COR stakeholders must prioritize addressing control and coordination activities in a professional and standardized manner, such as by implementing modular approaches. In this study, 'CH2: Decision Problems' and 'CH3: General Management Complexities' emerge as the second most significant challenges, each with a percentage of 93.Table 2. Validation of challenges in COR

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Challenges	Experts' perception (n=60)							
	Agreed the issue was a challenge (+ve) (*)			Disagreed that the issue was a challenge (-ve)			Neutral (N)	
	SA	A	% of +ve	SD	D	% of (-ve)	NS	% Of N
CH1: Control and Coordination Challenges	4	54	96	0	1	2	1	2
CH2: Decision Problems	14	42	93	0	2	3	2	3
CH3: General Management Complexities	19	37	93	0	2	3	2	3
CH4: Security and Compliance Challenges	17	38	91	0	1	2	4	7
CH5: Poor Contract Management	11	43	90	0	1	2	5	8
CH6: Different Cultural Issues	20	34	90	0	2	3	4	7
CH7: High Cost (For example, hidden cost, coordination cost, etc.)	17	36	88	0	1	2	6	10
CH8: Poor Human Resource Management	13	39	86	0	5	8	3	5
CH9: Modern Technological Challenges	14	38	86	0	5	8	3	5
CH10: IT Transitions Difficulties	12	38	83	1	2	5	7	12
CH11: Risky Contracts	13	34	78	0	3	5	10	17

Adequate attention to these challenges, through measures like recruiting skilled personnel, is crucial for competitive success. The study [32] illustrates a failed outsourcing project, emphasizing the risks associated with diverse cultures and languages in outsourcing. Face-to-face communication challenges due to geographically dispersed teams further highlight the need for vigilance. 'CH4: Security and Compliance Challenges' ranks third at 91%, urging COR stakeholders to address it by acquiring competent staff and specialized software

Following challenges, 'CH5: Poor Contract Management' and 'CH6: Different Cultural Issues,' both stand at 90%. Managing contracts in the COR context, involving stakeholders from diverse cultures, proves to be a complex task. Notably, 'CH5: Poor Contract Management' holds the highest frequency in literature via SLR, reinforcing its significance. Other challenges include 'CH7: High Cost' (88%), 'CH8: Poor HRM' (86%), 'CH9: Modern Technological Challenges' (86%), 'CH10: IT Transition Difficulties' (83%), and 'CH11: Risky Contracts' (78%). These findings align with the outcomes of our SLR [26], emphasizing the need for careful consideration by COR stakeholders to successfully navigate these challenges and manage relationships.

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Continent based analysis

To address RQ 2, we gathered a total of 60 responses from various continents, including Asia, Europe, America, Australia, and Africa. However, for making readiness of the paper easy, we have streamlined our analysis into two main groups: Asia and Others. We received 23 responses from the Asia group and 37 responses from the Others group. Throughout the data collection and analysis using SPSS, we employed the abbreviations SA (Strongly Agree), A (Agree), NS (Not Sure), DA (Disagree), and SDA (Strongly Disagree). The summarized results are presented in Table 3.

In simplifying the data, we combined SA (Strongly Agree) and A (Agree) into the Agree category, and SD (Strongly Disagree) and DA (Disagree) into Disagree.

Table 3. Continent based data analysis

S.NO	Challenges	Total Responses (n = 60)										Chi-square test (linear-by-linear) α = 0.05), df=1	
		Asia (N=23)					Others (N=37)						
		SA	A	NS	DS	SDS	SA	A	NS	DA	SDA	X^2	P
1	CH1: Control and Coordination Challenges	1	20	1	1	0	2	35	0	0	0	.087	.768
2	**CH2: Decision Problems**	**3**	**17**	**1**	**2**	**0**	**8**	**29**	**0**	**0**	**0**	**.027**	**.869**
3	**CH3: High Cost**	**3**	**17**	**1**	**2**	**0**	**9**	**23**	**5**	**0**	**0**	**.028**	**.867**
4	**CH4: Security and Compliance Challenges**	**5**	**17**	**1**	**0**	**0**	**10**	**22**	**4**	**1**	**0**	**.005**	**.943**
5	**CH5: Risky Contracts**	**6**	**10**	**5**	**2**	**0**	**9**	**21**	**5**	**2**	**0**	**.004**	**.949**
6	CH6: Poor Human Resource Management (HRM	4	14	1	4	0	9	24	2	2	0	.084	.926
7	CH7: IT Transitions	5	12	4	2	0	7	25	4	0	1	.107	.743

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	Difficulties												
8	CH8: Poor Contract Management	5	14	3	1	0	8	27	3	0	0	.254	.614
9	CH9: Different Cultural Issues	6	13	2	2	0	15	20	2	0	0	.061	.804
10	CH10: General Management Complexities	6	14	1	2	0	12	22	2	1	0	.077	.781
11	CH11: Modern Technological Challenges	6	13	2	2	0	7	26	1	3	0	.132	.716

The corresponding results for the table data is also shown in Figure 1, below.

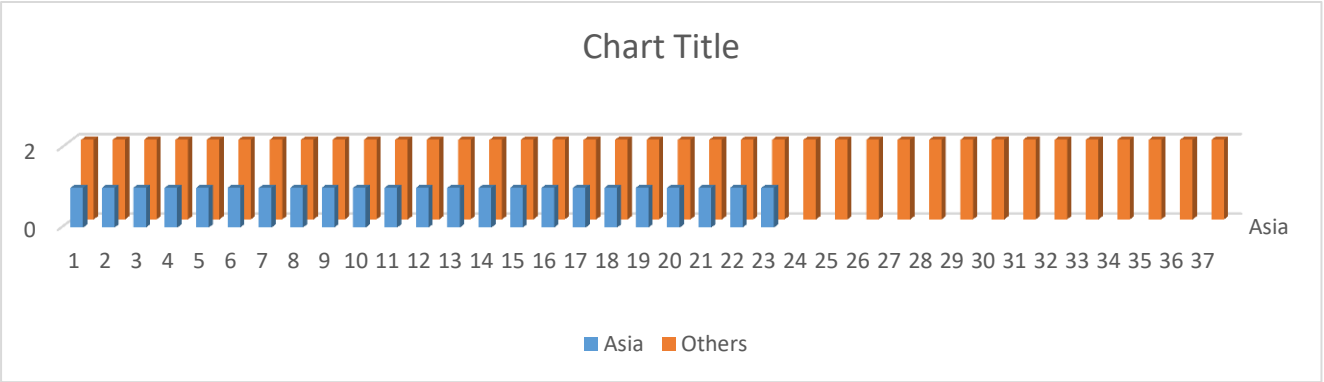


Fig 1. Continent-based data analysis

Similarly, the "CH2: Decision Problems" challenge follows with the highest positive frequency of 95%, comprising 20 Agree responses and a total of 37 (57 out of 60). As a result, "CH2: Decision Problems" is identified as the second most critical challenge in navigating complex outsourcing relationships. The subsequent positions of challenges with their frequencies of Agree and Disagree are shown in a Chart 1, below:

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Chart1.

Position	Agree (Frequency)	Disagree (Frequency)	Challenge
3rd	19 and 35 (total = 54)	1	CH5: Poor Contract Management
4th	20 and 32 (total = 54)	2	CH4: Security and Compliance Challenge
5th	19 and 35 (total = 54)	2	CH6: Cultural Issues
6th	20 and 34 (total = 54)	3	CH13: General Management Complexities
7th	20 and 32 (total = 52)	2	CH7: High Cost
8th	**19 and 33 (total = 52)**	**5**	**CH9: Modern Technological Challenges**
9th	**18 and 33 (total = 51)**	**6**	**CH8: Poor HRM**
10th	17 and 32 (total = 49)	3	CH10: IT Transition Difficulties
11th	**16 and 30 (total = 46)**	**4**	**CH11: Risky Contracts**

The analysis reveals interesting insights, particularly in terms of disagreement frequencies. Notably, "CH6: Poor Human Resource Management" stands out with the highest Disagree frequency at 6, constituting 10% of responses. Additionally, "CH11: Modern Technological Challenges" and "CH5: Risky Contracts" share the same level of disagreement, each with a frequency of 5 and a percentage of 8.33 and 6.66, respectively. These challenges are highlighted in bold for emphasis. Despite the varying degrees of disagreement, it's evident that each challenge is considered critical, with positive frequencies surpassing 90%.

Furthermore, the application of the Linear-by-Linear Chi-Square test uncovered significant differences across continents. Noteworthy disparities were found in "CH2: Decision Problems," "CH3: High Cost," "CH4: Security and Compliance Challenges," and "CH5: Risky Contracts," indicated by bold font for clarity. This method, known for its effectiveness in testing the differences of ordinal variables, provides a robust examination of the data, revealing specific challenges that exhibit significant variations across continents [33].

Analysis based on organization's size

In addressing RQ 3, we categorized organizations based on size, considering the SERG specialist's criteria:

- Large: Greater than 200
- Medium: 20-199
- Small: Less than 20

The responses were distributed among these categories, resulting in 16 responses from Large companies, 43 responses from Medium-sized companies, and only 1 response from Small companies. For simplicity, we combined SA (Strongly Agree) and A (Agree) into the Agree category, and SD (Strongly Disagree) and DA (Disagree) into Disagree. The summarized results are presented in Table 4.

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Table 4. Data analysis based on organization's s size

S.NO	Challenges	Total Responses (N = 60)									Chi-square test (linear-by-linear) α = 0.05), df=1	
		Large (N=16)			Medium (N=43)			Small (N=01)				
		A	N	DA	A	N	DA	A	N	DA	X^2	P
1	CH1: Control and Coordination Challenges	16	0	0	41	1	1	1	0	0	.297	.585
2	CH2: Decision Problems	15	0	1	39	2	1	1	0	0	.260	.649
3	CH3: High Cost	9	5	2	42	1	0	1	0	0	.630	.427
4	CH4: Security and Compliance Challenges	13	2	1	41	2	0	0	1	0	.337	.561
5	CH5: Risky Contracts	11	4	1	37	6	1	0	0	1	.096	.756
6	**CH6: Poor Human Resource Management (HRM**	**16**	**0**	**0**	**34**	**5**	**4**	**0**	**0**	**1**	**.017**	**.896**
7	CH7: IT Transitions Difficulties	12	3	1	39	3	1	0	0	1	.190	.662
8	CH8: Poor Contract Management	15	0	1	38	5	0	1	0	0	.112	.912
9	CH9: Different Cultural Issues	15	0	1	38	4	1	0	0	1	.112	.912
10	CH10: General Management Complexities	15	1	0	39	2	2	1	0	0	.147	.903
11	CH11: Modern Technological Challenges	13	1	2	38	2	3	1	0	0	.150	.698

It is evident from the results that "CH1: Control and Coordination Challenges" maintains its prominence across organizations of varying sizes, with the highest positive frequency of 96%. Large, Medium, and even Small organizations recognize its significance, placing it at the top position.

Similarly, "CH2: Decision Problems" emerges as the second most critical challenge, with a consistent positive frequency of 95% across all organization sizes—Large, Medium, and Small. Alongside, "CH10: General Management Complexities" shares this position with the same positive frequency of 95%. These findings emphasize the universal importance of addressing challenges related to decision-making and general management complexities in the context of COR.

The subsequent positions of challenges, along with their frequencies of Agree and Disagree, are likely illustrated in a chart 2, providing a comprehensive view of how organizations of different sizes perceive and respond to these challenges.

The challenges "CH11: Modern Technological Challenges" and "CH6: Poor HRM" exhibit the most Disagree responses, each scoring a negative 5 with a corresponding percentage of 8.33%. We have made these challenges conspicuous by presenting them in

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bold text. It is important to note that the positive response frequency for each challenge surpasses 90, underscoring their significance within their respective contexts.
Additionally, when applying Linear-by-Linear Chi-Square analysis, "CH6: Poor HRM" stands out with a chi square value of .017, which is less than .05. To emphasize this result, we've highlighted it in bold format. No other noteworthy discrepancies were observed among the remaining 10 challenges.

Analysis based on organization's scope

To find answer to RQ 4, we have considered it across National and International organizations. The challenges such as "CH1: Control and Coordination Challenges" remains a significant
concern, cited with the highest positive frequency of 96%. This suggests that irrespective of the organizational scope, control and coordination are critical aspects that demand attention.
Similarly, "CH2: Decision Problems" follows closely, securing the second-highest positive frequency of 93% across both National and International organizations. This indicates a shared recognition of the challenges associated with decision-making in the context of COR.
The chart 3, below, likely illustrates the subsequent positions of challenges, along with their frequencies of Agree and Disagree, providing a visual representation of how these challenges are perceived and acknowledged across different organizational levels.
It is notable that "CH6: Poor HRM" and "CH11: Modern Technological Challenges" face the highest levels of disagreement, each with a frequency of 5 and a percentage of 8.33%. These challenges are highlighted in bold, emphasizing the areas of contention.

Chart 2.

Position	Agree (Frequency)	Disagree (Frequency)	Challenge
3rd	15, 39 and 1 (total = 55)	2	CH3: General Management Complexities
4th	13, 41 and 0 (total = 54)	1	CH4: Security and Compliance Challenges
5th	15, 38 and 1 (total = 54)	1	CH5: Poor Contract Management
6th	15, 38 and 0 (total = 53)	3	CH6: Cultural Issues
7th	9, 42 and 1 (total = 52)	3	CH7: High Cost
8th	**13, 38 and 1 (total = 52)**	**5**	**CH9: Modern Technological Challenges**
9th	12, 39 and 0 (total = 51)	3	CH10: IT Transition Difficulties
10th	**16, 34 and 0 (total = 50)**	**5**	**CH8: Poor HRM**
11th	11, 37 and 0 (total = 48)	3	CH11: Risky Contracts

The corresponding results for the table data is also shown in Figure 2, below.

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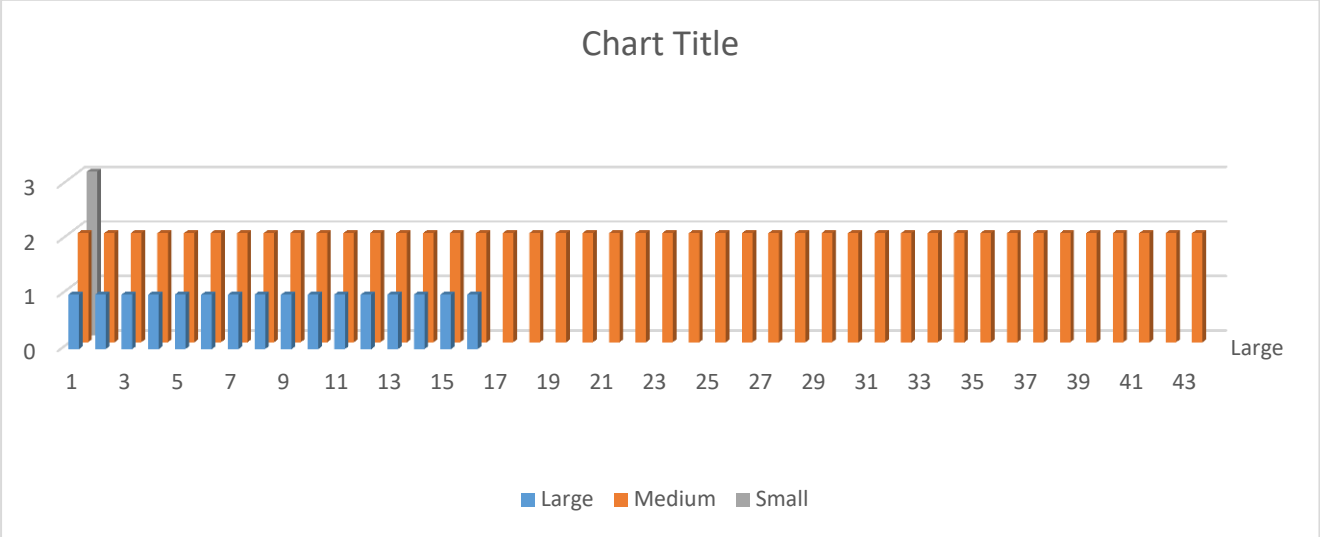


Fig 2. Data analysis based on organization's size

Chart 3.

Position	Agree (Frequency)	Disagree (Frequency)	Challenge
3rd	37 and 18 (total = 55)	1	CH7: High Cost
4th	36 and 19 (total = 55)	2	CH5: Poor Contract Management
5th	36 and 19 (total = 55)	2	CH3: General Management Complexities
6th	36 and 18 (total = 54)	1	CH4: Security and Compliance Challenges
7th	36 and 18 (total = 54)	2	CH6: Cultural Issues
8th	**36 and 16 (total = 52)**	**5**	**CH8: Poor HRM**
9th	**33 and 19 (total = 52)**	**5**	**CH9: Modern Technological Challenges**
10th	35 and 16 (total = 51)	2	CH10: IT Transition Difficulties
11th	36 and 12 (total = 48)	3	CH11: Risky Contracts

Despite these disagreements, the positive frequency for each challenge remains higher than 90%, underscoring their critical nature in their respective contexts.

Moreover, through the Linear-by-Linear Chi-Square test, a significant difference was identified for "CH11: Modern Technological Challenges" with a chi-square value of .046, highlighted in bold for clarity. This statistical insight suggests that Modern Technological Challenges might exhibit variations in perception across National and International organizations.

These findings provide a nuanced understanding of how challenges are perceived and contested within different organizational levels, shedding light on areas that may require specific attention and strategies. The outcomes of their responses to the identified challenges in COR are presented in Table5.

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Table 5. Data analysis based on organization's s scope

S.NO	Challenges	Total Responses (n = 60)						Chi-square test (linear-by-linear) α = 0.05), df=1	
		National (38)			Multi-National (N=22)				
		A	N	DA	A	N	DA	X^2	P
1	CH1: Control and Coordination Challenges	37	1	0	21	0	1	0.312	.576
2	CH2: Decision Problems	36	1	1	20	1	1	.167	.682
3	CH3: High Cost	37	1	0	18	3	1	.325	.568
4	CH4: Security and Compliance Challenges	36	2	0	18	3	1	.158	.691
5	CH5: Risky Contracts	36	2	0	12	7	3	.167	.682
6	CH6: Poor Human Resource Management (HRM	36	1	1	16	2	4	.221	.631
7	CH7: IT Transitions Difficulties	35	3	0	16	4	2	.091	.762
8	CH8: Poor Contract Management	36	2	0	19	3	0	.127	.721
9	CH9: Different Cultural Issues	36	2	0	18	2	2	.178	.673
10	CH10: General Management Complexities	36	2	0	19	1	2	.179	.672
11	**CH11: Modern Technological Challenges**	**33**	**3**	**2**	**19**	**0**	**3**	**.046**	**.830**

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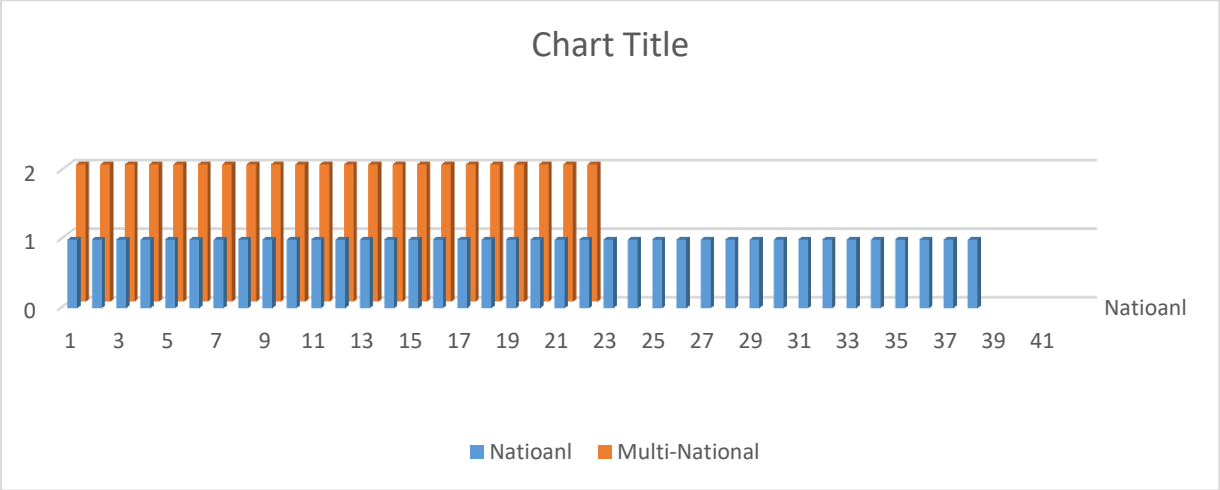


Fig 3. Data analysis based on organization's scope

Their responses for the identified challenges in COR are shown below in Table 6.

Table 6. Analysis via SPI certification's-based

S.NO	Challenges31	Total Responses (N = 60)									Chi-square test (linear-by-linear) α = 0.05), df=1	
		CMMI & ISO (N=23)			CMMI (N=31)			ISO (N=06)				
		A	N	DA	A	N	DA	S	N	DS	X^2	P
1	**CH1: Control and Coordination Challenges**	**22**	**1**	**0**	**31**	**0**	**0**	**5**	**0**	**1**	**.000**	**1.0**
2	**CH2: Decision Problems**	**20**	**1**	**2**	**30**	**1**	**0**	**6**	**0**	**0**	**.003**	**.956**
3	CH3: High Cost	21	0	2	26	5	0	6	0	0	.128	.720
4	**CH4: Security and Compliance Challenges**	**20**	**2**	**1**	**29**	**2**	**0**	**5**	**1**	**0**	**.008**	**.928**
5	CH5: Risky Contracts	18	4	1	26	4	1	3	2	1	.216	.642
6	CH6: Poor Human Resource Management (HRM	21	1	1	28	2	1	3	0	3	.071	.789
7	CH7: IT Transitions Difficulties	20	2	1	27	4	0	4	0	2	.056	.812
8	**CH8: Poor Contract Management**	**21**	**2**	**0**	**29**	**2**	**0**	**5**	**1**	**0**	**.004**	**.949**
9	**CH9: Different Cultural Issues**	**20**	**2**	**1**	**29**	**2**	**0**	**5**	**1**	**0**	**.008**	**.928**

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10	**CH10: General Management Complexities**	**20**	**2**	**1**	**30**	**1**	**0**	**5**	**0**	**1**	**.002**	**.964**
11	CH11: Modern Technological Challenges	21	0	2	26	3	2	5	0	1	.360	.548

The findings demonstrate that "CH1: Control and Coordination Challenges" remains the most frequently cited challenge, with positive frequencies of 96%, encompassing 22, 31, and 5 responses from organizations holding CMMI & ISO, CMMI only, and ISO only certifications, respectively. Similarly, the challenge of "CH2: Decision Problems" follows closely, achieving the highest positive frequency of 93%, with 36 and 20 responses from National and International organizations, respectively. The chart 4, below, illustrates the positions of subsequent challenges, depicting their frequencies of agreement and disagreement

Chart 4.

Position	Agree (Frequency)	Disagree (Frequency)	Challenge
3rd	21, 29 and 5 (total = 55)	0	CH8: Poor Contract Management
4th	20, 30 and 5 (total = 55)	2	CH3: General Management Complexities
5th	20, 29 and 5 (total = 54)	1	CH4: Security and Compliance Challenges
6th	20, 29 and 5 (total = 54)	1	CH6: Cultural Issues
7th	21, 26 and 6 (total = 53)	2	CH7: High Cost
8th	**21, 28 and 3 (total = 52)**	**5**	**CH8: Poor HRM**
9th	**21, 26 and 5 (total = 52)**	**5**	**CH9: Modern Technological Challenges**
10th	20, 27 and 4 (total = 51)	3	CH10: IT Transition Difficulties
11th	18, 26 and 3 (total = 47)	3	CH11: Risky Contracts

The data indicates that only two challenges, namely "CH6: Poor HRM" and "CH11: Modern Technological Challenges," have the highest disagreement rate of 5, accounting for 8.33% of the total participants. This implies that the agreement percentage for these challenges is also higher than 90%. Overall, this data reinforces the critical nature of all challenges faced by stakeholders dealing with complex outsourcing relationships.

To discern significant differences across the data based on SPI certification, the Linear-by-Linear Chi-Square analysis was conducted once again, yielding notable results as outlined in Table 6. Challenges such as "CH1: Control and Coordination Challenges," "CH2: Decision Problems," "CH4: Security and Compliance Challenges," "CH8: Poor Contract Management," "CH9: Different Cultural Issues," and "CH10: General Management Complexities" exhibit significant variations. The chi-square values for these challenges, highlighted in bold, are .000, .003, .008, .004, .008, and .002, respectively, emphasizing their distinct impact in the context of SPI certification.

The corresponding results for the table data is also shown in Figure 4, below.

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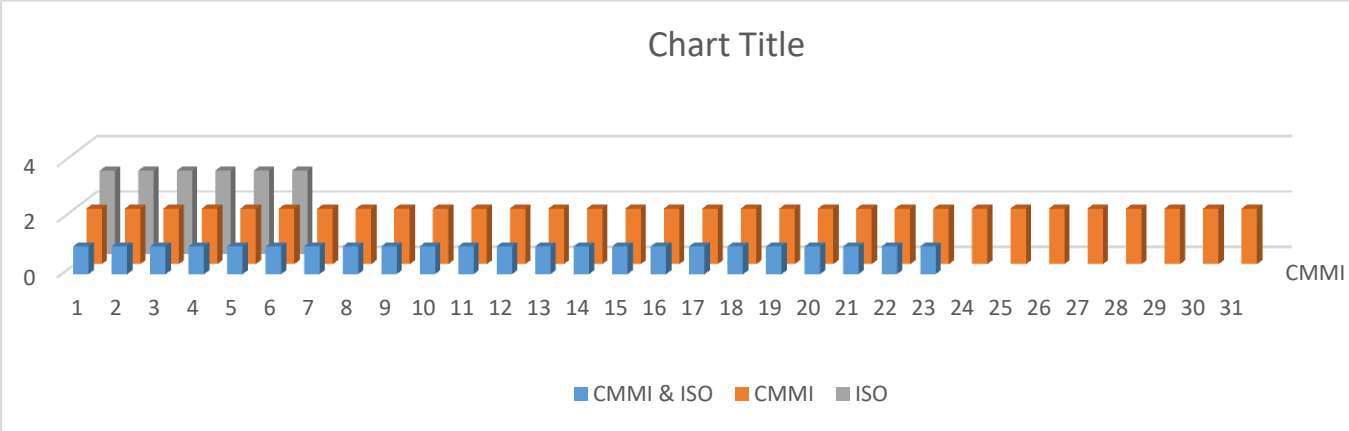


Fig 4. SPI certification's-based data analysis

Analysis based on employee's experience

To address RQ 6, we conducted a detailed analysis of responses based on the experience of the involved employees. The categorization was done in yearly intervals as recommended by experts from the outsourcing community, particularly SERG specialists. In this categorization, we received 12 responses from employees with less than 5 years of experience, 40 responses from those with 6-10 years of experience, and 8 responses from individuals with 11-15 years of experience. The outcomes of their responses to the identified challenges in COR are presented in Table 7.

It is notable that "CH1: Control and Coordination Challenges" maintains its prominence across different levels of employee experience, with the highest frequency of agreement in all categories. This indicates that control and coordination challenges are consistently recognized as the foremost challenge in navigating complex outsourcing relationships, regardless of the employees' level of experience.

Table 7. Employee's experience-based data analysis

S.NO	Challenges31	Total Responses (N = 60)									Chi-square test (linear-by-linear) α = 0.05), df=1	
		1 - 5 Years (N=12)			6 – 10 Years (N=40)			11-15 Years (N=8)				
		A	N	DA	A	N	DA	S	N	DS	X^2	P
1	CH1: Control and Coordination Challenges	12	0	0	38	1	1	8	0	0	.375	.540
2	CH2: Decision Problems	11	1	0	35	4	1	7	1	0	.164	.685
3	CH3: High Cost	11	1	0	36	3	1	7	1	0	.221	.638
4	CH4: Security and Compliance Challenges	9	3	0	34	4	2	5	2	1	.138	.710
5	CH5: Risky Contracts	10	0	2	34	3	3	8	0	0	.131	.717

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6	CH6: Poor Human Resource Management (HRM	10	1	1	34	4	2	7	1	0	.163	.686
7	CH7: IT Transitions Difficulties	11	0	1	32	6	2	7	1	0	.068	.794
8	CH8: Poor Contract Management	11	1	0	35	3	2	8	0	0	.166	.638
9	CH9: Different Cultural Issues	11	1	0	36	3	1	8	0	1	.221	.638
10	CH10: General Management Complexities	12	0	0	37	1	2	7	1	0	.264	.607
11	CH11: Modern Technological Challenges	10	0	2	36	2	2	6	1	1	.285	.593

Similarly, "CH2: Decision Problems" remains significant, with the highest positive frequency of 93%. This suggests a shared acknowledgment of the challenges associated with decision-making in the context of COR across various levels of employee experience.

The chart 5, next, likely provides a visual representation of the subsequent positions of challenges, along with their frequencies of agreement and disagreement. It's fascinating to observe how these challenges are perceived across different experience levels.

The data underscores that "CH11: Modern Technological Challenges" is distinct in having the highest disagreement frequencies, reaching a negative frequency of 5 and a percentage of 8.33%. This challenge is highlighted in bold for clarity. Despite this, it's crucial to emphasize that the positive frequency for each challenge surpasses 90%, affirming the critical nature of each challenge within its specific context.

Chart 5.

Position	Agree (Frequency)	Disagree (Frequency)	Challenge
3rd	11, 36 and 8 (total = 55)	2	CH6: Cultural Issues
4th	11, 36 and 7 (total = 54)	1	CH7: High Cost
5th	11, 35 and 8 (total = 54)	2	CH5: Poor Contract Management
6th	11, 35 and 7 (total = 53)	1	CH2: Decision Problems
7th	10, 34 and 8 (total = 53)	3	CH8: Poor HRM
8th	**10, 36 and 6 (total = 52)**	**5**	**CH9: Modern Technological Challenges**
9th	10, 34 and 7 (total = 51)	3	CH5: Poor Contract Management
10th	11, 32 and 7 (total = 50)	3	CH10: IT Transition Difficulties
11th	9, 34 and 5 (total = 48)	3	CH11: Risky Contracts

Additionally, the absence of significant differences in the results indicates a consistent perception of challenges across different levels of employee experience. The

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corresponding results presented in Figure 5 likely offer a visual representation of how these challenges are perceived and addressed within the varying landscape of employee experience.

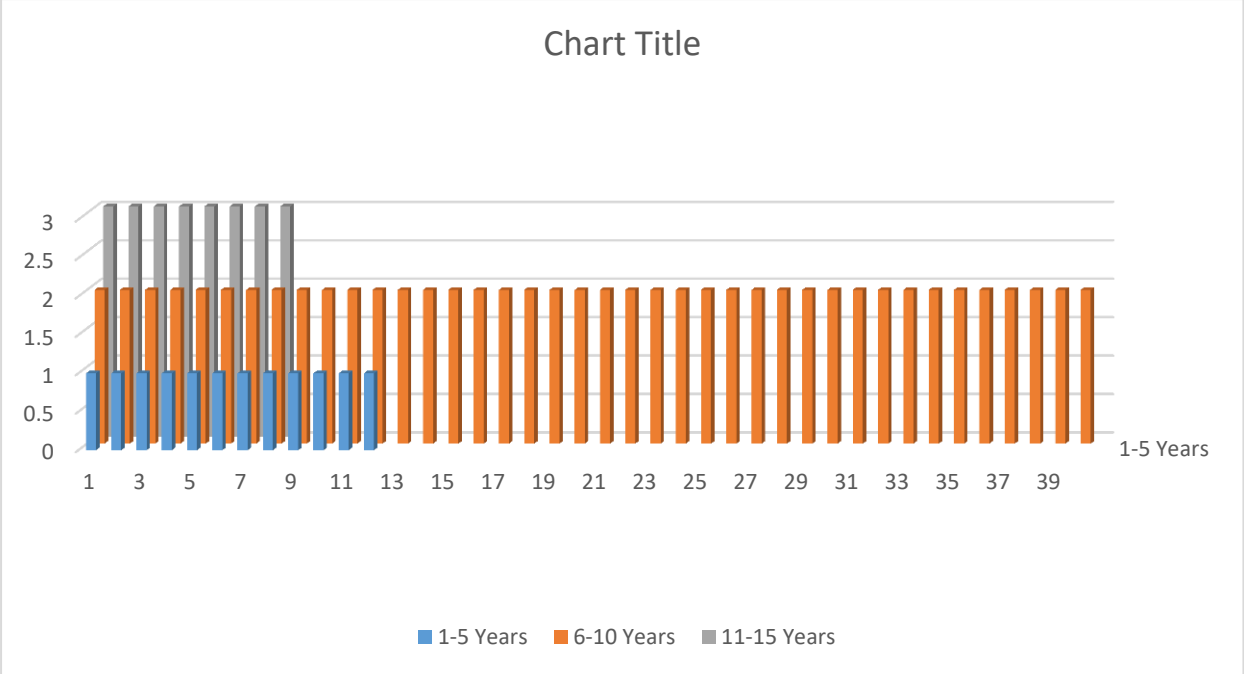


Fig 5. Employee's experience-based data analysis

Analysis based on employee's job states

To address RQ 7, we conducted a thorough analysis of the data based on the employee's status within an organization. The responses were categorized into three groups: CEO/Manager, Engineer/Developer/Administrator, and Others,
which includes individuals like Architects, Scholars, etc.
The 'Others' category comprises individuals such as academics and researchers who possess expertise or prior experience in software outsourcing, in accordance with recognized standards in the existing literature [29]. Our survey yielded 11 responses from CEOs or Managers, 43 responses from individuals in roles such as Engineers, Developers, and Administrators, and 6 responses from the 'Others' category. The results of their responses to the identified challenges in COR are detailed in Table 8.

Table 8. Employee's job states-based data analysis

S.NO	Challenges	Total Responses (N = 60)									Chi-square test (linear-by-linear) α = 0.05), df=1	
		CEO/Manager (N=11)			E/D/A (N=43)			Others (N=6)				
		A	N	DA	A	N	DA	A	N	DA	X^2	P

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1	CH1: Control and Coordination Challenges	11	0	0	42	1	0	5	0	1	.730	.392
2	CH2: Decision Problems	11	0	0	39	2	2	6	0	0	.251	.616
3	CH3: High Cost	10	1	0	38	5	0	6	0	0	.187	.665
4	CH4: Security and Compliance Challenges	9	1	1	41	2	0	4	2	0	.464	.495
5	CH5: Risky Contracts	9	0	2	35	8	0	5	0	1	.129	.719
6	CH6: Poor Human Resource Management (HRM	10	1	0	39	1	3	3	1	2	.260	.610
7	CH7: IT Transitions Difficulties	8	3	0	37	4	2	5	0	1	.185	.667
8	CH8: Poor Contract Management	11	0	0	37	5	1	6	0	0	.148	.700
9	CH9: Different Cultural Issues	11	0	0	38	3	2	5	1	0	.196	.657
10	CH10: General Management Complexities	11	0	0	39	2	2	5	0	1	.251	.616
11	CH11: Modern Technological Challenges	10	0	1	38	2	3	4	1	1	.254	.614

It is interesting to observe that "CH1: Control and Coordination Challenges" continues to be prominently acknowledged across different employee statuses, securing the highest frequency of agreement in all categories, whether CEO/Manager, E/D/A (Engineer/Developer/Administrator), or Others.

Additionally, "CH10: General Management Complexities" emerges as the second most significant challenge, a noteworthy shift in perspective compared to previous findings. This change in ranking might offer insights into evolving perceptions or challenges faced in the realm of COR across different employee statuses.

The chart 6 likely provides a visual representation of the subsequent positions of challenges, along with their frequencies of agreement and disagreement. It is significant to note that both "CH11: Modern Technological Challenges" and "CH6: Modern Technological Challenges" face the highest disagreement frequencies of 5, highlighting potential areas of contention or varied perspectives among respondents. Despite this, the overall agreement percentage for each challenge remains higher than 90%, underscoring the general consensus on the critical nature of each challenge in its respective context. Moreover, the absence of significant differences in the data suggests a consistent perception of challenges across different employee statuses within organizations.

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Chart 6.

Position	Agree (Frequency)	Disagree (Frequency)	Challenge
3rd	11, 39 and 5 (total = 55)	3	CH3: General Management Complexities
4th	11, 38 and 6 (total = 54)	0	CH7: High Cost
5th	9, 41 and 4 (total = 54)	1	CH4: Security and Compliance Challenges
6th	11, 37 and 6 (total = 54)	1	CH5: Poor Contract Management
7th	10, 38 and 5 (total = 54)	1	CH6: Cultural Issues
8th	**10, 38 and 4 (total = 52)**	**5**	**CH9: Modern Technological Challenges**
9th	**10, 39 and 3 (total = 52)**	**5**	**CH8: Poor HRM**
10th	8, 37 and 5 (total = 50)	3	H10: IT Transition Difficulties
11th	9, 35 and 5 (total = 49)	3	CH11: Risky Contracts

This consistency might imply a shared understanding of the complexities and issues associated with COR, regardless of the specific role or status within the organizational hierarchy.

Figure 6, showing the results.

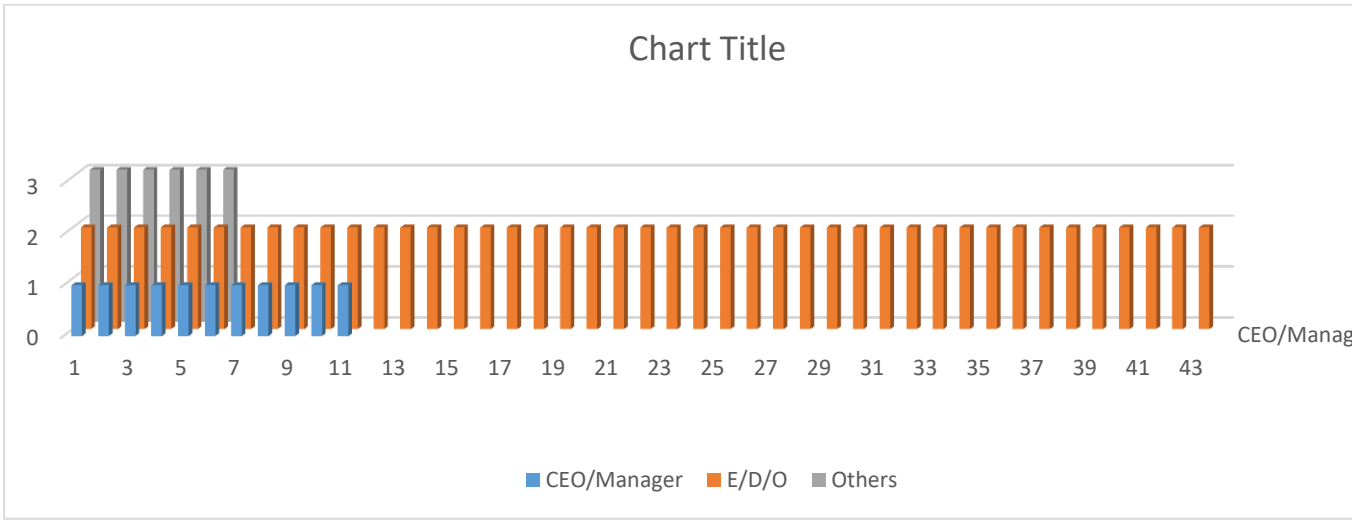


Fig 6. Employee's job states-based data analysis

Limitations of the study

Construct validity, which examines whether measurement scales accurately represent the traits being measured, is a crucial aspect of research. In this study, the qualities used were grounded in prior research, as summarized in [33-36]. Participants' comments indicated that the factors considered were relevant to their work, providing a foundation for construct validity.

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Internal validity, essential for establishing the overall quality of results, was supported by deriving variables through a thorough literature analysis and question piloting. The pilot trials contributed to a satisfactory level of internal validity.

External validity, the extension of findings to settings beyond the initial study, was considered [37]. While questionnaires were employed, a potential drawback is that respondents might focus only on listed factors. To address this limitation, respondents were encouraged to describe any additional factors not covered in the questionnaire. Empirical evaluation of practices for identified challenges was not conducted due to time constraints. However, confidence in findings stems from gathering information from practitioners directly involved in outsourcing activities, working in various roles. These practitioners' experiences were independently researched without the researchers' preconceptions, aligning with established practices in similar studies based on experiential data [29, 38-40].

Conclusion

This paper presents empirical survey results as its primary contribution. The survey results serve to substantiate, through practical evidence, the crucial challenges within the domain of complex outsourcing relationships. The online questionnaire survey engaged 60 industry practitioners, representing a diverse range of insights from 20 countries worldwide. Its purpose was to validate and delve deeper into the findings of the Systematic Literature Review (SLR), which marked the initial phase of the research project, from an empirical standpoint.

The survey results not only confirm the conclusions drawn from the SLR but also closely scrutinize the outcomes from multiple vantage points, revealing a strong alignment between them.

It is noteworthy that this paper presents the questionnaire survey results as an integral part of a comprehensive research project which aims to identify the key challenges and practices in order to cope with the challenges in the form of Complex Outsourcing Relationships Management Model (CORMM).

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