Overcoming Requirements Engineering Challenges:
Lessons from Offshore Outsourcing

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Case studies from an Indian IT-services firm provide insights into the root causes of RE phase conflicts in client-vendor offshore-outsourcing relationships.

According to Gartner, globalization of software development has expanded rapidly in recent years and has brought a wake of changes that impact application development projects.[1] With outsourcing on the rise, every relation between an outsourcer and a vendor calls for collaboration between multiple organizations across multiple locations. As part of a global IT-services organization with high process maturity, we've had many opportunities to understand the requirements engineering life cycle related to global software development. RE is a software project's most critical phase;[2,3] the RE phase's success is essential for the project's success.

Many studies have highlighted RE challenges related to the geographic distribution of global software development.[4–7] Here, we focus on challenges arising out of a client-vendor offshore-outsourcing relationship. On the basis of our experiences in real-life projects and recommendations in literature, we propose success factors and best practices, which can go a long way in addressing RE challenges.

The detailed case studies we present should help both clients looking to outsource their software requirements and vendors involved in software outsourcing.

Offshore outsourcing's impact on RE

Figure 1 shows the typical stakeholders in an outsourced software project. We can use this scenario to highlight four common characteristics of a software project outsourced offshore and the impact on RE activities.

The first common characteristic is that a vendor typically faces two stakeholders of the client organization: the client's IT group and its business community (managers and users). Similarly, the client must deal with two segments of the vendor organization—the colocated vendor coordination team and the offshore project development team. This arrangement, more often than not, causes a split between the groups with decision-making and project-execution power (usually offshore) and the group with the knowledge of the stakeholder needs (usually colocated). Multiple groups channel the interaction between the requirements provider (business community) and solution provider (vendor). This arrangement impacts RE in three ways. It requires a more rigorous requirements change-management process (which increases
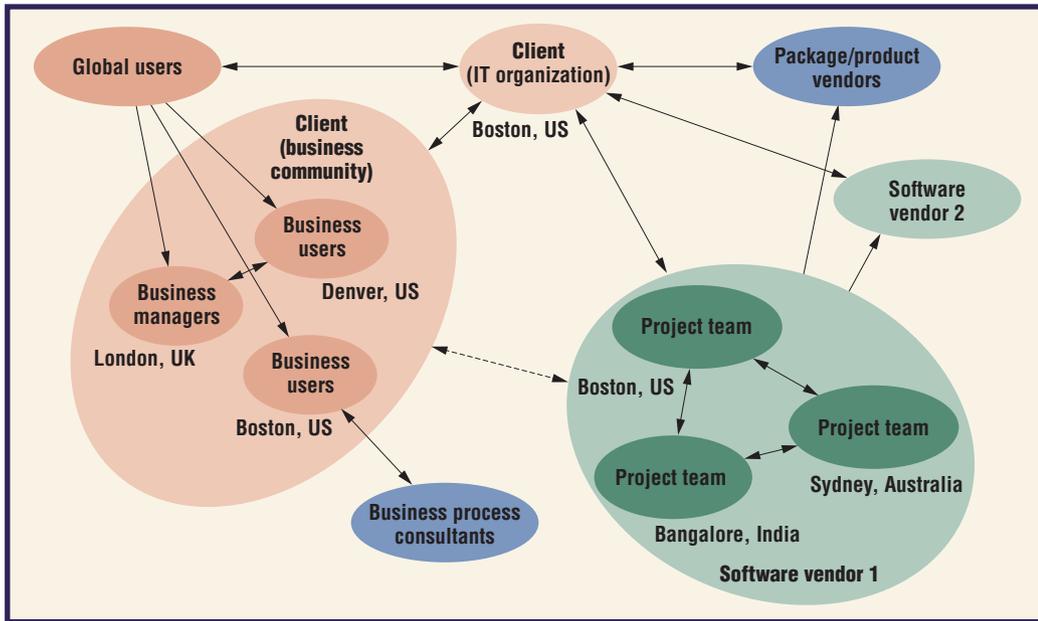
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Figure 1. Typical stakeholders in an outsourced software project (the dashed line represents indirect communication, routed through the client IT organization).

overhead), as the information-handoff points and separation between decision-makers increase. Failing to follow the process religiously can disrupt the formation of a common understanding of the requirement change. It also slows client-vendor requirements negotiation, owing to the constant back-and-forth of information from one site to another. Finally, it creates many degrees of formal separation between stakeholders at the same level of organizational responsibility. This can lead to biased and incomplete views that diminish transparency in eliciting, negotiating, and validating requirements.

The second common characteristic is the existence of multiple RE processes and tools across organizations and locations. This impacts RE in two ways. Having multiple tools, templates, and methodologies that don't integrate or interoperate can lead to wasteful RE rework or loss of data during transfer from one tool to another, which can increase requirements defects. It also leads the vendor and client to introduce different standards of requirements documentation owing to different levels of the teams' RE process maturity.

The third common characteristic is the differences in organizational culture or location-specific work cultures between the client and vendor teams. Existing literature deals extensively with how cultural differences such as

work ethic, work hours, importance of hierarchy, mode of communication, and concern for quality can impact RE.[8,9]

The fourth common characteristic is ad hoc staffing of client and vendor team formations leading to multiple transitions across locations between the outgoing and incoming team members.[10] This churn in people adds new perspectives and information to a project life cycle. However, because RE phase stakeholders must be accountable for the functionality delivered, this churn can result in a software project remaining incomplete or the user community not accepting the software.

These characteristics create many RE challenges, as practitioners of global software development projects have witnessed in recent years. These challenges increase many times if more than two organizations are involved in offshore outsourcing.

Real-life case studies

An exhaustive list of our experiences is beyond this article's scope, but we share a few of our experiences from randomly selected projects to provide a detailed view of the challenges just presented. We hope these cases will be of value to practitioners as well as researchers who might have had similar experiences or might not have witnessed these situations in experimental studies.

Case 1: Conflicting client-vendor goals

In one project, a vendor team had to help migrate an inflexible legacy system with a high total cost of ownership to a portfolio of sophisticated systems based on the latest technology. The initial part of the statement of work involved detailing enterprise-wide business requirements, to be followed by detailed requirements gathering for application development.

Vendor project team members, working under the scope and approach defined in the contractual statement of work, wanted to complete the enterprise-wide requirements before going into the details and measured the team's success on how effectively (high speed, high quality, low cost) it did so. However, to reduce the time to market, the client's CIO wanted to proceed on the basis of priority, first completing detailed requirements for one specific business area. A meeting between client and vendor decision makers failed to find a resolution, because the remotely located vendor team members with RE process knowledge couldn't participate. This created a conflict, because as the vendor team introduced more resources to accelerate the pace of collecting the enterprise-wide business requirements, the CIO maintained focus to prioritize one specific business area. Because the two organizations' stakeholders didn't explicitly discuss the business goals and their rationale, neither side appreciated the RE exercise's outcome.

Case 2: Low client involvement

A vendor project team working between Europe and India was bothered by the lack of the client teams' involvement in the RE exercise. In particular, two issues were decreasing the project team's confidence in its ability to deliver on time and within budget.

First, the client and vendor organizations spoke different native languages, so information the vendor sought about the requirements was shared only based on specific questions and only through certain bilingual individuals. This reduced the flow of other contextual or open-ended information, which is necessary to develop a full understanding of the client's needs. So, part of the RE documentation was based on assumptions derived from brief conversations.

Second, the schedule for completing the requirements documentation suffered because the client team members didn't turn up for face-to-face meetings in spite of accepting the

meeting requests in their calendar. However, they responded promptly to email.

To add to the problem, RE experts from the vendor country work culture assumed they had little authority to continuously pursue the client team. This resulted in multiple escalations and complaints about the lack of progress to higher authorities in both organizations.

Case 3: Conflicting RE approaches

A large project faced issues when the RE teams comprising members of both the client and vendor organizations repeatedly failed to meet RE document milestones. The issue started with the division of RE documentation work across subteams according to the client's data model. The vendor teams protested because they had never approached the RE exercise starting from a data model. Instead, the vendor preferred to segregate teams according to the business processes that needed to be automated, so that each team could focus on business requirements related to a logical set of business processes.

This clash in viewpoints delayed the scope definition and RE template finalization for each team. Even when some colocated teams from the client accepted the vendor's approach to RE, there was discord in the client organization at remote locations. This resulted in a lack of cooperation by client stakeholders who disagreed, disrupting RE process control.

Case 4: Misalignment of client commitment with project goals

A challenge surfaced in a client-vendor relationship where the client had contracted software development of an intricate financial system to the vendor on a fixed-price basis. The client organization had planned an ambitious time-to-market for the project based on urgent market demand.

At the start of the RE process, the vendor assumed responsibility for meeting a deadline for RE, with its payment schedule strictly linked to achievement of important milestones. The client assigned a team of business analysts to work with the vendor, but only a certain amount of time was available in the analysts' busy schedules. As weeks went by, the vendor team kept slipping one milestone after another due to insufficient inputs, unavailability of the right resources, and a lack of management attention in providing information on require-

ments. The vendor organization's decision-makers couldn't put the process on track in a timely manner owing to their remote presence. This led to extreme frustration among the project owners as the vendor saw slippages in its contractual payment schedules while the client wasn't willing to accept a delay in the requirements phase deliverables.

Case 5: Disagreements in tool selection

The client and vendor teams had problems after discussing a relevant tool for requirements management. While the client's quality manager insisted on using a newly acquired expensive tool, the vendor teams preferred to use a homegrown set of tools they were accustomed to. The client and vendor teams interacting over phone and emails across two continents couldn't reach a consensus after repeated attempts.

Eventually, the vendor accepted the client's tool choice to maintain the relationship. However, when the project started and the vendor team traveled to meet the client team for requirements gathering, the team realized that the newly acquired tool was available for only a single licensed user, and the tool vendor couldn't provide basic training. This opened another debate when the client suggested a generic documentation tool as an alternative to the vendor's specialized tool. However, this time both the teams quickly came to agreement when the vendor demonstrated a small but effective pilot of its own tool through face-to-face interactions with the client.

Case 6: Communication issues

When a vendor RE team working with a client RE team moved from onshore to offshore, the project suddenly experienced a slowdown in resolving issues between the two teams. Before the move, issues were resolved informally in face-to-face meetings, whereas later, the client team no longer resolved issues that were communicated over emails or phone calls. This caused a lack of trust in the offshore team, who couldn't complete their work because of an accumulation of outstanding issues. The onshore team reduced its communication with the offshore team, because it felt it was suddenly being given too many issues.

Case 7: Disowning responsibility

A vendor RE team lost its morale when the client demanded completion of work under strict deadlines as per the RE success criteria. Owing to an unanticipated complication in collecting the requirements, the vendor team had to work overtime and was still not meeting all the deadlines. Because of the close interaction they enjoyed with the client team members, they expected the client's project sponsor to accept the delays in good faith. Furthermore, the sponsor didn't share responsibility for the delays, even when delays in input from the client organization were cascading into delays in deliverables from the vendor.

Case 8: Sign-off issues

A project faced sign-off issues on RE deliverables when the vendor couldn't connect directly with the business users to obtain their requirements. The vendor RE team working with the IT analysts' team from the client couldn't successfully complete its deliverables owing to insufficient information from the IT analysts. This created a loop in the client organization, with IT analysts sending the queries to the actual business users and passing the replies back to the RE team. Any follow-up questions raised by the RE team went through the same loop.

After rounds of clarification and information gathering, the IT analysts provided their sign-off on RE documentation without thoroughly understanding the business requirements. This concerned the vendor, so it resumed the sign-off process only when the client organization provided a stakeholder who better understood the requirements to sign-off on the documentation.

Case 9: Tools misaligned with expectations

The vendors' offshore team of RE experts failed to help its onshore RE team, due to a wrong tool choice. The onshore RE team wanted to leverage the "follow the sun" model of working and requested that offshore RE experts provide screen mock-ups based on use-case requirements documentation. The onshore team expected to provide a quick turnaround of this task, exchanging use-case documents and the corresponding screen mock-ups daily. However, to their surprise, the offshore RE experts took almost three times as long in the first exchange. On analysis, we realized that the offshore team was using a specialized tool that provided better output and required more effort, whereas the onshore team only wanted a rough sketch to have a discussion for requirements validation with the client's business users.

The schedule for completing requirements documentation suffered because the client team members didn't attend face-to-face meetings.

Strategic success factors based on root-cause analysis

After reviewing the case studies, a key question is, "How can we address these challenges?" Recent literature has focused more on solving issues arising from geographically distributed RE, while we look at RE challenges arising specifically in a client-vendor offshore-outsourcing scenario. We hope that our insights and analysis of these experiences in greater detail help identify recommendations for RE practices both at a strategic (what) as well as tactical (how) level that can be used in real-life projects.

A simple root-cause analysis of the nine case studies reveals key strategic factors that are essential to RE's success in a client-vendor relationship.

Shared goal

Root-cause analysis of cases 1 and 9 reveals that RE performance suffers when the stakeholders aren't aligned to the same objective. As Line Paré and Guy Dubé observed, true collaboration through mutual responsibility and alignment of efforts requires a common vision.[10] Peta Darke and Graeme Shanks' proposal for managing conflicts and inconsistencies in stakeholder viewpoints also supports the importance of a shared goal.[11]

Shared culture

Culture plays an important role in any team activity's success. Analyzing case 2 reveals a lack of shared culture between the team members. Geert Hofstede's seminal work identifies the key factors driving cultural differences among individuals.[8] Recent research[4,5,12] includes cultural norms or values, language, and tacit knowledge that drive the behavior of various team constituents as well.

Shared process

Process specifies the methodology for developing RE artifacts for each activity's inputs and outputs and for the tools, techniques, and templates used to fulfill the process objectives. Cases 3 and 6 depict the challenges caused by the lack of a shared process. Previous research also reveals the importance of process alignment between teams.[6]

Shared responsibility

RE is the most intricate part of software de-

velopment in terms of its dependency on disparate stakeholders for planning, gathering inputs, documentation, analysis, negotiation, validation, and review. In various instances of client-vendor collaboration in the RE life cycle, the division of responsibility between the client and vendor is at best ambiguous. Cases 4 and 7 reveal lack of shared responsibility as the root cause of problems. This inference agrees with existing research.[5,13]

Trust

This is the underlying glue that strengthens each of the previous success factors. Lack of trust can deprive the project of one or more success factors, while sufficient trust can help introduce them at a faster pace.

A holistic framework for RE best practices

The next stage in our analysis was to seek RE practices that help achieve strategic success factors during the RE life cycle. RE practices should provide a ground-level approach to achieve strategic-level objectives. Here we present a holistic framework for identifying such practices.

Given the quality and quantity of research and field experiences in RE, it's safe to assume that the complete list of RE best practices suggested in the literature would collectively address a vast majority of the RE challenges faced in global software development. A typical problem that practitioners face is picking the right practice to apply in a real-life context. This problem is aggravated when, even though multiple practices tackle similar RE challenges, they're neither mutually exclusive nor collectively exhaustive.

The first step in addressing this issue is to have a framework for classifying practices that gives a quick assessment of available practices and identifies areas of unexplored territory that can be the subject of future research. From a popular business management view, we can exhaustively identify best practices for any given problem in terms of their impact on the people, process, and technology.

Our experience shows that most RE practices recommended for distributed software development teams are relevant for client-vendor outsourcing in global software development. On the basis of a literature survey and our practical insights, table 1 provides a partially

Table 1

Best practices to achieve the strategic success factors

Success factors	Best practices		
	People	**Process**	**Technology**
Shared goals	■ Develop a stakeholder viewpoint[11] ■ Include team member satisfaction in the project success factor[6]	■ Build the team vision collaboratively[10]	■ Use a human facilitator in integrated, rich communication media during decision making[4]
Shared culture	■ Provide cultural training to team members[14] ■ Train team members on using communication technology[14]	■ Build consensus on formal operating norms for meetings, deadlines, and commitments[10] ■ Facilitate communication sessions to allow every member to speak[14] ■ Share requirements-specification templates[6]	■ Establish technology accessibility and compatibility for all teams[5]
Shared process	■ Train team members to use the right processes, tools, and technologies[7]	■ Use distributed Quality Function Deployment for requirements prioritization[15] ■ Create a proper project structure clearly showing the value and dependency of each activity and artifact[7] ■ Adopt a standard way to work (for example, the CMM)[12] ■ Maintain and share a project-artifacts repository[4] ■ Share requirements specification templates[6]	■ Use electronic mediation (computer conferencing) to enable remote participation of conflicting stakeholders during requirements negotiation[16]
Shared responsibility	■ Develop practical performance metrics and project-reporting mechanisms[10] ■ Obtain access to key users for requirements gathering[5]	■ Increase visibility with frequent deliverables[10]	■ Establish a requirements awareness system, outlining people's roles and responsibilities[13]
Trust	■ Get team together at the formation stage for a face-to-face kickoff session[10]	■ Build team vision collaboratively[10] ■ Schedule ongoing informal meetings[4]	■ No practice available

filled framework of RE best practices for each strategic success factor. We believe that this framework will get continuously enhanced with more practices from both research and industry experiences.

RE teams working in client-vendor outsourcing relationships face challenges that traditional software engineering practices don't directly address. Lessons from practitioners and researchers based on real-life experience add a lot of new practices that address many of these challenges. We hope to continue our observation of emerging RE practices and assess their impact with respect to the strategic framework. We urge the IT community to bring new insights and perspectives to build on the best practices and provide maturity to the framework in the context of global software development. ⁘

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