Managing Offshore Outsourcing of Software Testing

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Abstract

Offshore outsourcing is becoming more lucrative in the light of organizations’ desires to become low-cost yet high quality service providers. Within the context of software development, much of the outsourcing research has broadly focused on outsourcing without special attention to the nature of what is being outsourced and whether it has any impact on client-vendor relationships. Also extant research has paid little attention to the challenges brought by offshore outsourcing. With this concern, the current research reports our preliminary findings on various aspects of an offshore outsourcing relationship for software testing. Data collection for this research was conducted at a large multinational service organization.

1. Introduction and motivation

Enabled by the globalization and advances in information and communication technologies, offshore outsourcing of software development to countries such as India, China, and Russia, etc., has increased. Activities such as requirements analysis, design, coding/programming, testing, support, maintenance, etc., that comprise software development are being outsourced to these offshore destinations with varying levels of intensity. While software programming, support, and maintenance-related activities are being outsourced to offshore destinations primarily, outsourcing of software testing related activities to offshore destinations is becoming increasingly beneficial.

As software becomes pervasive in our everyday life, it is important to test software thoroughly. One study measuring software development processes found 41% of the project effort was spent in testing, 25% in designing, 13% in coding, and 21% in other activities (Waligora & Coon, 1994). Industry trends indicate software testing is becoming a larger part of software development projects. With testing consuming much of the resources used in software development, it becomes a viable candidate for delegation to vendors. Another driving force is to shrink time-to-market without compromising software quality under tight pressures to meet development deadlines.

Existing research on offshore outsourcing has focused on various aspects of outsourcing. For example,

- What are various best practices in developing outsourcing contracts (Lacity & Willcocks, 1998)
- Institutional pressures that influence outsourcing decisions in the financial services industry (Ang & Cummings, 1997; Ang & Straub, 1998),
- Political and professional institutional role in outsourcing decisions (Miranda & Kim, 2006),
- Impact of internal and external sources of influence on outsourcing decisions (Ho, Ang, & Straub, 2003; Loh & Venkatraman, 1992),
- Joint effects of contractual hazards and technological capabilities on the outsourcing decision (Mayer & Salomon, 2006),
- Relationship between IT outsourcing strategies (e.g., degree of integration, allocation of control, and performance period) and outsourcing success (e.g., strategic competence, cost efficiency, and technology catalysis) (Lee, Miranda, & Kim, 2004),
- Factors (e.g., role overload, the presence of strong ties between manager and contractor, and the lack of prior outsourcing experience) influencing managerial expectations in a spin-off type outsourcing relationship (Ho, Ang, & Straub, 2003), and
2. Research methodology

In the current project, we use case study methodology and qualitative data analysis techniques to develop a model of best practices for offshore outsourcing of software testing. In the next phase of this study not yet performed, we will use survey research methodology to triangulate our findings from our case study. This paper reports our preliminary findings from the first phase—the case study.

The results reported are based on interviews with various software testing stakeholders in a large Fortune 500 organization with substantial offshore outsourcing activities. The company has about 5,500 information technology employees overall, with 3 directors, 14 managers, and 149 full-time employees in the testing organization. The company works with 7 separate contracting vendors and has about 3-4 major releases of new and modified software versions a year.

Our data gathering for this phase began with interviews with client and vendor testing stakeholders to identify and better understand the issues related to offshore outsourcing of software testing. These stakeholders include macro-level contract managers, micro-level testing management, offshore vendor personnel, and other software development managers. In total, we interviewed 14 stakeholders. Interviews were conducted from December 2006 through February 2007.

3. Data analysis and results

Analysis of transcripts of interviews of 14 offshore software testing stakeholders resulted in several major themes. Each major theme is described further in the following subsections.

3.1. Contracting with vendors

The first category involves the need for macro-level contracting with vendors. This involves creating a high-level governance-type agreement between the client and the vendor. While a micro-level statement of work can detail the tasks to be accomplished and set specific service levels for a specific job, the high-level agreement clearly defines issues such as privacy, ownership, pricing, remedy, risk of loss, and provisions for the statement of work. A separate contracting office (or centralized vendor management office) negotiates and manages these high-level agreements in an effort to make the best use of resources and reduce redundancies related to contract negotiations. The high-level agreement results in a list of vendors who are pre-authorized and pre-approved for managers throughout the organization to negotiate with for their specific statements of work. Pre-authorizing the use of a short list of vendors helps in
cost negotiations, as selected vendors can expect enough business to be able to reduce their rates. Furthermore, a centralized vendor management office can perform vendor audits, monitor vendor performance, track contract defaults, compare vendor cost and pricing structures, and ensure information security requirements are being followed by the vendor.

Another important finding involves the need to match the high-level agreements and the statements of work with the actual work environment that is occurring. For example, the contract does not match the work environment when there is a fixed price contract and set statement of work that does not allow for increases in the amount of work being accomplished. The client may need more work to be done, but the contract is set at a fixed price, with the vendor possibly doing the extra work in order to maintain the working relationship with the client. Without this work explicitly being stated in the contract or in a change order, it goes unrecorded. Thus, neither the client nor the vendor management team fully understands the level of effort needed by the vendor to accomplish a specific set of tasks. With fixed price contracting, the risk of not being able to accurately predict the amount of testing work at software release time is transferred to the vendor. If the risk is shifted to the vendor, the client gets predictability of their software testing costs and flexibility in the work effort.

As part of the contracting process, a statement of work is needed to clarify the work to be accomplished for a particular job. The vendor works with the client to create the statement of work with both parties agreeing on the contents before it is signed off and given to each party’s legal department. This document specifies the information flows, the people involved in communicating the work efforts, as well as their relationships and reporting structures. The statement of work specifies how the work is split into meaningful chunks; which chunks of work are the vendor’s responsibility; how the client will track vendor's progress; the ways to measure, track and report work progress; and how corrective actions will be implemented.

3.2. Offshoring strategy and cost-benefit

Though a key factor for doing work offshore is the cost, other benefits of offshore outsourcing are speed to market, lower costs, well-trained work force, and a willingness to do the level of work needed to get the job done. Given the time differences, the client can see the results of work done the previous night.

Offshore outsourcing seems to offer cost-saving, however the exact amount is unknown. Using vendors allows the client to deal with the workload (i.e., testing) as a more variable cost than if in-house employee time was used to do the work. Even though saving money is a driver of offshoring, the loss of knowledge of how the work gets done and the hidden cost of contracting and managing vendors may reduce the cost savings.

Large companies in the United States (U.S.) are facing the need to reduce their fixed cost of full-time employees. By offshoring work, these companies get fixed costs as well as a variable work capacity. Software testing is a type of work that fits this model very well. Vendors are able to provide variable work capacity because of their pool of capable available employees as well as other skilled technical people available for hire as needed. These vendors can also move their employee resources to other projects when the work for one client is completed.

Offshoring work is seen as a highly viable and necessary solution to the need to be cost effective. This strategy makes it increasingly necessary for client employees to monitor vendors’ work. While offshoring helps get the work done, it must be managed and monitored properly.

3.3. Expectations of vendor performance

From the micro level of working with vendors, especially for software testing, clients may demand a lot from the vendors. Not only might they ask for more work from vendors at a fixed cost, but they might ask vendors to find ways to reduce these costs. With the goal of reducing the testing cycle time, the client has had to change expectations and change what work gets done. For example, the client may encourage the vendor to find ways to run fewer tests. Clients and vendors need to work together to do better testing at lower cost. More success will occur when the vendors are treated as partners in this effort and are assured that getting the work completed faster typically results in more work for the vendor overall.

Even though more and more work can be demanded of offshore vendors at the same or lower costs, it is important to keep in mind the quality of life for vendors. In India, people in poverty fight to get into schools and become engineers. They are willing to work very hard to have this opportunity. Client organizations need to be careful not to overdo the vendor employees’ workload and thus deprive them of a decent quality of life.
3.4. Management of vendors

One of the major challenges of working with offshore vendors is for the client to develop vendor management and interaction roles. Someone at the client organization must coordinate the work with vendors and stay in touch with them. For example, a vendor test lead should report to an employee test lead. The client employee could have two or three onsite vendor representatives with multiple products and multiple releases being worked on as long as the employee has the bandwidth to check all the vendor outputs and deliverables.

A client must trust but verify what the vendor says about the work status. For example, the client and vendor use the same testing tools which allow the client to review the time and date stamps of the test cases that are executed out of that tool. If the tests are accessed from offshore but run on-site, the client can monitor the work. In other cases, the vendor uses tools offshore and they upload the results to the client’s system. In this case, knowing the work was done is a matter of trust between the vendor and client. It benefits the vendor to actually do the work, because if their work is not high quality they might not be given more work or be asked to work on the next software release. As the number of vendors and their employees working for the client grows, it becomes more difficult to keep an adequate span of control of the offshore vendor employees. Increasing vendor work creates more overhead costs for the client in monitoring and controlling the work.

One challenge with testing work being performed with vendors on a deliverables-basis involves the knowledge of the work effort residing with the vendor. The vendor does not disclose the number of people working on the job or work processes needed to meet the work production criteria and standards. When going out to bid for the next testing work, the client then does not have work effort information.

One important factor to ensure adequate communication and knowledge transfer is to have a full-time employee presence at the vendor location, which brings visibility to the work processes. If a full-time presence is not possible, doing site visits routinely can be informative. Even if the vendor appears to be delivering quality services, on-site visits are needed to see the morale, conditions, and other issues. Given the complexity of the work performed in software testing, face-to-face interaction is required at some level. Direct interactions and discussions between client and vendor are factors that are important for successful outsourcing. Also, it is important for the client to share their appreciation for vendor employee work.

Communication between the vendor and client is very important. Methods that help with communication include partnering with the vendor, giving them clear expectations, asking them to provide regular status reports at a detail level, and communicating regularly with weekly calls, daily emails, and performance reviews. Other methods include talking to the test leads offshore, looking daily at the log of defects, performing walk-throughs, and holding conference calls. Vendors need to understand what to do as well as why the work is being done. The relationship between vendor and client works more smoothly if the client says what is happening and the reason for any changes in direction. For example, in software testing, if the client just gives the vendor the test cases and says to execute them, not much communication is needed. But if the client wants the vendor to understand the application, more communication is required so that the vendor understands what is documented, what is not known about the application, what are the interfaces, and who are the people to talk to.

Another important communication point is to help vendors prioritize the work. In software testing the workload varies and the client must let the vendor know changes in priorities. The client must daily redirect the order of the work being done. The client must prioritize the work for vendors so if they hit a roadblock, they do not stop working altogether. Prioritizing the work will allow vendors to go on to the next task.

Given all the complexities with client and vendor relationships, starting to work with a new vendor presents several challenges. With a new vendor, it is beneficial to expect them to have a heavy on-site presence initially. In this way, communication and knowledge transition issues are worked through. Someone from the client’s information security area may need to work with someone from the vendor locally to be in the same working business hours in order to figure out what connectivity processes are needed. Also vendor training is needed onsite, which includes knowledge transfer. The vendor employees must have a way to acquire knowledge of the client’s execution processes, validation methods, measurement systems, and technical tools, and this training is best done at the client’s site. It typically takes one software release for the vendor employees to be fully effective and to really understand what is done at the client’s operations.

3.5. Offshoring issues with vendor
Offshoring work adds complexity and barriers to getting the work done. If the vendor makes a mistake and does not inform the client, the client will eventually discover that a mistake has been made, but at a much later point in time. This is a cultural issue where people in the United States are more open to reporting mistakes, while in Asia the culture does not support admitting mistakes. Another cultural difference between India and the U.S. involves the ability to say “no”. People in India tend to say “yes” but they may not mean it, so clients need to be very specific and persistent in setting these expectations. To ensure successful communications, clients must routinely follow up with vendors.

If work is performed at the client’s site, managers can see the work being done and manage what resources are performing what tasks. If the work is performed offshore, managers are removed from the work and lack the ability to visually monitor and manage the work. With deliverables-based contracting, the focus is on the outcomes of vendor work and not the vendor’s staffing and work processes. Thus the client must trust the vendor will get the work done.

The centralized vendor management office has established rules for working with vendors, including the need for test execution to be performed offsite, separate work spaces for vendors, and not allowing vendors to be treated as client employees. Other issues involve intermittent work outages because of local issues such as political unrest. Also, offshore vendors also take days off on holidays celebrated on both sides.

The Indian culture (or the contract) does not reward innovativeness. Indian vendors are not naturally innovative because their history and culture does not have a reward structure for this. If it requires creative thinking and creative trouble shooting, it can be more difficult for them to solve. This makes it difficult to get improvement ideas from vendors on how to do software testing better.

Another issue with working with offshore vendors is time zone differences. However, global companies already face similar issues with their own internal offices communicating worldwide. It becomes difficult to reach all the people you need to reach when they are dispersed across the globe. Video conferencing is very difficult because of different time zones. For smooth work transitions, there needs to be overlap in the work performed so that the offshore folks adjust their time schedule to the onshore folks before passing off the work. This time schedule is written into the contract. To properly coordinate work, there are phone calls every day and night as well as weekly in the middle of the night.

3.6. Technology infrastructure issues

Setting up the working technology infrastructure can be a critical issue. Infrastructure issues can delay getting the work done. Client employees must help the vendor figure out infrastructure issues. Sometimes it is difficult to figure out if it is a vendor problem or client problem. Even more challenging is that with offshore locations, the client cannot send their employees over to the vendor site to help them figure it out. The client relies on emails going back and forth, trouble tickets going back and forth, and phone calls but miscommunications may still slow down the process. In fact, there can be an infinite number of variables causing the infrastructure to malfunction, including software that the vendor installs or the number of hot patches on their operating system. Sometimes in order to mix the infrastructure, client employees need to be able to get to that environment.

Furthermore, information security issues are major challenges. To work together, the client needs to transfer software or other information to and from the vendors, they need to send emails back and forth, or they need to provide access to the vendors to work on secure FTP sites. However, there are many information security requirements that govern these information exchanges, making it difficult to work efficiently and effectively. It takes administrative time and face-to-face communication to work out these details.

Firewall issues and permissions rules also inhibit the ability to set up connectivity between the vendor and client. Certain technology access is only available at the client site, even only in certain rooms. In the client’s technology labs, certain technology access is granted. Additional restrictions to technology apply for offsite offices that the vendor works out of. In each location different technology access applies.

3.7. Management within the vendor company

There has been considerable growth in India, and vendor resources move around. This is not a quality issue but a stability issue. An employee who has worked with a vendor company on a specific client contract for a long time learns to understand the client’s culture for quality, reliability, and productivity. There needs to be more stability. Clients can work with one vendor, but if they have high turnover, there are problems.
Also, there must be a representative on-site from the offshore vendor, that person coordinates the work, but must be careful so that miscommunication is avoided. This person needs to make sure information given to the offshore employees is followed correctly and that the work actually gets done. The onsite vendor employee creates the documents and checklists for the roles and timing of each project team member. The onsite vendor employee takes the nighttime conference calls with the offshore folks and offers a single point of contact for the onsite client folks. The onsite vendor employee has to know how to communicate with both onsite and offshore people by using web conferencing, email, and phone communications. The onsite vendor employee expedites the process of communicating with those offshore to save time. If there is no vendor representative onsite, the project fails because communication is lost when the work is moved offshore. The onsite vendor employee must have a strong ability to explain technical work and must have knowledge about client operations.

While some amount of onsite presence is required, the right number is not entirely clear. A vendor test lead spends a lot of time speaking to marketing and development, for example, reducing the time spent coordinating offshore. But coordinating is still a required task and there are tasks that involve working with other client people during the day. An important reason for a vendor representative to remain at the client site is because it gives the vendor access to certain systems onshore that are not available offshore.

Offshore vendor employees need to be trained on how to communicate with client employees. Specifically they need to learn and understand accent and tone differences to communicate better with their U.S. clients. Communications are critical because in India there could be a person offshore not trained to understand U.S. accents. Offshore folks may understand and translate the message, but there are numerous occasions when unwittingly miscommunications may happen.

Oftentimes vendors know how to make the outsourcing relationship work better. Vendors analyze how best outsourcing offshore will work, they send their best employees to the client site to share their knowledge, and often the client does not have the experience or understand how offshore works best. One onsite vendor representative may cover four or five projects that are going on at a client site. These vendor employees help the client define a roadmap and strategy for getting work done.

### 3.8. Vendor provides a level of services

One reason for the trend to offshore software testing work is that they have a lot more resources and talent than U.S. companies could afford to keep on staff. In India, vendors have access to a large resource pool with skills with many technologies, frameworks, and methodologies. Indian vendors hire and train their people in all aspects of software development and testing skills. One vendor has a training center, were they monitor how people work and capture metrics. If a person performs well, that person gets to work on the actual client tasks. These resources are missing in the U.S. as there is not a big enough resource pool.

Indian vendors have better processes than U.S. vendors. They may not be great innovators, but they are great engineers, they take processes and refine them completely. They can streamline work that has been done and drive out inefficiencies. The Indian culture is very good at executing things that are simple and well documented.

Vendor selection and interaction decisions can vary widely. At the client site the work itself is not uniform across the divisions of the company. Some managers micro manage vendors while others just ask that the vendor checks in before making critical decisions. Regardless of the importance of the work given to vendors, vendors cannot be involved in vendor selection and decisions of what the client wants to spend on testing.

### 3.9. Testing work issues

One problem with testing is that there are numerous approaches to testing and no single “best practice.” There is no clear definition of what testing a piece of software means. Testers now get involved in the planning phase, but they need solid processes of how testing can best support each phase of software development. They do not have a strong test policy for all stages of the system development lifecycle.

Another issue is the complexity of the systems to be tested. One client application is ten years old, is huge, has no manuals, has code that has been appended year after year, and the back-end and front-end systems have changed. It takes years to understand this complexity and to know how to troubleshoot it and where all the failure points are. That makes it very difficult to test, especially when you do not know the client’s business rules. Parts of testing can be highly automated and simplistic while others are not. There is a perception that testing can all be automated and offshored which may not be true.

Within the realm of testing work, testing automation is a challenge to vendors. The client has
used some vendors for more than eight years. This has allowed the vendors to gain domain knowledge, but over the years they let their employee headcount increase. This became a problem because the client has asked the vendor to invest in automation, which should decrease their headcount. The client also asked the vendor to use automated tests on 90% of their software applications.

Also, to reduce testing cycle time, the vendor contracts are written so automation tests should be written before the software is ready to test. That is, the contracts specify that all manual and automatic tests should be written and ready before the test cycle begins, in order to reduce testing cycle time. However, there is little incentive to do work before there is software to test. If vendors reduce cycle time, they believe they will earn less money.

Even with manual execution, there is no incentive for vendors to do work up front before testing begins. Yet the client wants to reduce testing cycle time through automation. The next step is to mandate that if the automated tests are run offshore, the client wants to see it run onshore as well. The client wants to know it is running and that the vendor is not helping it along by fixing the problems in the automation code. Automations can help increase the number of defects found, but if the vendor does it offshore, the client may not see what those defects are. The vendor has no incentive to log the defects when they run it offshore. So the client has to mandate that defects are logged.

3.10. What testing work to send offshore

Intellectual property including highly critical testing activities should not be sent offshore. The client’s proprietary knowledge, or decisions that could affect the client, should not be sent offshore. Most of the testing leadership should stay in house although the vendor needs to assume some leadership as well. Test execution and validation and regression are easy tasks to send offshore. Work that involves setting strategy, the need for information across company units, the need for interaction with other areas, work that is challenging, immature, complex, or where there are parallel teams should not be sent offshore.

Anything of high complexity, which is primarily from the number of systems as well as the communication and coordination across the system, should not be sent offshore. Immature products with substantial feature creep should not be sent offshore. Immature, chaotic, new development, multi-development teams, late requirements, changing requirement—none of these should be sent offshore. If the task requires creative thinking and creative trouble shooting, it is more difficult to send offshore. Thus, when offshoring complex work, it requires more effort on the client side to communicate and coordinate the work, leading to more opportunities for failure especially in a new relationship.

Work that is stable, mature, and simple efforts can be offshore successfully. If it is something that is routine, day-to-day activities that is manageable by offshore or onsite presence, it can be sent offshore. The work needs to be something the client can chunk up and send offshore and that needs little hand holding. New projects are better to keep onshore initially then send offshore as it goes to a new version or release. To determine what to send offshore, certain functions are easy to send—the rule is anything in operations, things that are repeatable, make excellent candidates for offshore.

Testing strategies, frameworks, and methodologies used should remain in house. Requirements determination should not be sent offshore. Requirements gathering folks must be collocated with their business customers (end users), as well as other aspects of operations, such as operations support, help desk tier 1 (i.e., where they open the problem log and includes the first level of analysis), but not help desk tier 2 (i.e., which involves deeper research to solve the problem). Test cases, design, and specification are alright to offshore outsource. Certain test designs, test cases, test scenarios, test case execution entry, scripting, test validation (pass/fail), validation, and tool creation, load test are alright to offshore outsource.

Test execution and validation and regression testing are easy tasks to send offshore. A client test designer is paired up with a vendor test analyst to work through execution and validation testing. The client does many of the test plans because they know the functionality of the business user. But if there are test plans for say, testing buttons (devices only), then the client lets the vendors create those test plans, create those test beds, run those walk-throughs, and do that testing execution.

Client management believes the vendor can develop test cases or test plans given specific requirements, and all of this should be done offshore. These tasks tend to be easy to monitor and have definable units of work. Vendors could even unit test if needed. Test design changes need to be onshore, new functionality needs to be maintained on shore. Vendor test leads only handle management tasks and do no test execution. Vendor test leads monitor work, pass on methods and frameworks and go to meetings for business requirements and development meetings.

Given this discussion, the client periodically goes through all roles of its own employees and decides if
that role was eligible to go offshore or stay onsite. Also, outsourced roles should get re-visited to see if they should come back inside.

4. Conclusions and contributions

The current project gathered and analyzed interview data from one large company and reported several useful outcomes, including: developing an initial knowledge base of factors to consider when working with offshore software testing vendors, examining issues in maintaining a desired balance between keeping critical business knowledge in-house versus delegating activities to offshore testing vendors, determining knowledge that is critical to retain internally, creating an unbiased external view of potential best practices for the delegation of work offshore, delineating the factors in cross-cultural remote management that impact the delegation of activities to offshore testing vendors, and establishing a baseline plan for expanding the research to examine other vendor issues related to software testing activities.

This paper represents the first phase of a two-phase research project. Phase one was a qualitative phase with internal offshoring management of a Fortune 500 company to gain insights about offshoring. The results of this phase of the study have provided valuable insights about various issues regarding managing offshore outsourcing of software testing. These results also serve as input for the quantitative stage of the study by means of providing the necessary elements for survey questionnaires. The next phase of this research project will involve data gathered via surveys of other Fortune 500 companies. The outcome will be a delineation of which factors of offshoring are agreed to by the management of other companies.

5. References