# A Survey of Enterprise Software Development Risks in a Flat World

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## Abstract

*COTS-based development and global delivery are two major disruptors in modern software development arena. Economic benefits offered by these disruptors cannot be neglected by organizations of any size. Unfortunately, alongside these benefits are several risk factors, which if ill-managed can cost the organizations both in terms of revenue and time. At Infosys, one of India's leading software services organizations, built upon global delivery model we conducted a study by interviewing representatives from 23 projects to identify risks pertinent to COTS-based development in a global setting. We found 6 frequently occurring risks that will be summarized in this paper.*

## 1. Introduction

Global delivery is a leading modern day disruptor in software development arena. In 2004 the top 3 software service organizations in India – TCS, Infosys and Wipro generated combined services revenue of US $4.5 billion, up by 47 percent from 2003, almost all from foreign customers. Such competition from Indian companies has compelled both Accenture and IBM to significantly increase their presence in India. In addition, with the increasing wages in India both Indian and foreign organizations have also committed resources to building a presence in emerging markets such as China, Malaysia, Brazil and Eastern Europe [6]. Global software development process involves a minimum of two teams working in sync: a skeleton team working at the *client location* responsible for project coordination, analysis and planning etc. and a larger team working at the *offshore development center* responsible for design, coding, testing etc.

Another significant disruption in the software development space occurred in late 1980s with the introduction of Commercial-Off-The-Shelf (COTS) software products. This gave rise to a whole new paradigm of 'buy vs. build' [5]. Such an approach allows the vendor to distribute COTS software development and evolution costs across multiple customers, resulting in lower cost per deployment. At the same time customers can acquire and deploy the software much more rapidly than having to build it themselves. Several organizations have opted to buy software components and in several cases entire solutions are made up of COTS software products. The Standish group survey for 2000 indicates over 54% of the software systems surveyed utilized significant number of COTS software packages [7]. Unfortunately, developing software using COTS products is not without risks [2]. Researchers have identified several risks faced when developing software using COTS software. They have also proposed resolutions [1][8] that have been successfully applied in software development projects.


**Figure 1: Global COTS-Based Software Development Process**

Together both these disruptors have created significant cost-saving opportunities for organizations. To obtain these benefits organizations utilize processes that implements best-practices from both these disruptors (example shown in Figure 1). In Figure 1activities P1, P2, and P4 are primarily conducted on client location, while activities P3 and P5 are executed from offshore development centers.

At Infosys headquarters and primary offshore development center in Bangalore, India we interviewed

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representatives from 23 software development and maintenance projects to identify major risks faced by such COTS-based global delivery engagements for clients in US and European Union. These projects were a part of the enterprise solutions practice within Infosys which is responsible for developing solutions using extremely large COTS products such as SAP and Oracle applications. Our preliminary results indicate several frequently occurring risks and causes of their occurrence which we will present in this paper. Where available, we have also included mitigation and risk avoidance strategies that have been successfully applied in these projects.

## 2. Research Methodology

The enterprise solutions practice at Infosys is divided into 9 sub-groups. Each sub-group is specialized in a specific COTS product or business domain. We conducted interviews in 7 of the 9 sub-groups. Two groups not considered were recently established and had less than 2 years of experience. A summary of the number development and maintenance projects involved in each of these groups is given in Table 1. We applied a 4 step process for identifying risks confronted by these projects:

**Step 1 – Artifacts Collection:** involved meeting with the project representatives (usually manager) to identify the artifacts relevant to this research. These identified and agreed upon artifacts are made available to the researcher at the end of the meeting.

**Step 2 - Artifact Review:** involved reviewing these artifacts to identify risks faced by these projects.

**Step 3 – Risk Analysis:** involved a second interview with the representative to determine the roots of risks and the mitigation strategies that were applied to resolve them.

**Step 4 – Pattern Recognition:** involved reviewing risks, their origins and mitigations from all 23 projects to identify commonly occurring risk patterns.

**Table 1: Projects Analyzed within the Enterprise Solutions Group at Infosys**

| *Enterprise Solutions Sub-Groups* | *Implementation & Enhancement* | *Maintenance & Support* |
|---|---|---|
| Business Intelligence (BI) | 2 | 0 |
| Customer Relationship Management (CRM) | 5 | 0 |
| Enterprise Application Integration (EAI) | 3 | 1 |
| Human Capital Management (HCM) | 1 | 2 |
| Oracle | 2 | 4 |
| SAP | 1 | 1 |
| Supply Chain Management (SCM) | 0 | 1 |

## 3. Global Software Development Risks

During our exercise we identified 20 risks that occurred in a minimum of 2 projects out of the 23 projects surveyed. This section highlights the 6 risks that occurred most frequently in the 23 projects. It is important to note that the risks defined here are from the perspective of an implementer or an integrator of COTS products. Figures listed next to the risk indicate the number of projects where the specific risk was identified.

**R1: Lack of adequate infrastructure support or infrastructure is unavailable (12):** Global delivery model relies exceedingly upon available network infrastructure that links the offshore development centers with the client locations. A failure in infrastructure leaves unutilized resources at the offshore development centers, resulting in wasted revenues and project delays. Note that the infrastructure needs will vary by the engagement, and should be evaluated before starting of the project. To reduce the probability of occurrence of this risk, available infrastructure service providers should be selected after detailed evaluation. Alternately, if the infrastructure service provider has been recommended by the client appropriate measures should be taken during contract negotiation phase to address such failure scenarios.

**R2: Delay in support from interfacing systems, resulting delays in present system implementation (6):** Large-sized systems are frequently implemented by multiple integrators. Typically, in such cases one part of the system depends upon the interfaces provided by another part. Several times because different integrators are involved for each of the system parts, and every integrator has their distinct priorities, support from the other integrator will be delayed, resulting in schedule delays for the present integrator. For such risks one risk transfer strategy [4] that can be applied is specifying adequate clauses pertinent to response times for such support requests in the engagement contract.

**R3: Unavailability of skilled resources – lack of technical or domain knowledge (10):** Large scale COTS products are usually packaged with exceptional tailoring or configuration support. Unfortunately, the configurations and tailoring language for each COTS product is distinct and can change significantly for new COTS releases. Moreover on an average a COTS product undergoes a major release every 9 months [2]. This results in lack of personnel with adequate experience in using specific COTS product. Correspondingly, there are numerous similarities in processes and operations within business domains such as high tech, banking and finance and human

resources. Knowledge of such processes is usually gained over several years of working in those domains, and can significantly speed up the process of understanding the clients' system requirements. Again, such experienced personnel are scarce. This risk further increases with high employee turnover rate. To reduce the impact caused by this risk teams are designed so that they include a combination of experienced and less-experienced personnel.

**R4: COTS not functioning as advertised or vendor not responding to product related issues (6):** Now and again COTS vendors have been known to have over advertised their products. This leaves the development team to discover functions which were advertised as complete are either incomplete or do not function as expected. In such a scenario, the teams are forced to either cancel implementing that specific function (if the function has a low-priority) or build custom extensions to the COTS in order to satisfy the functionality (in case of high priority functions). In addition, often times development teams identify bugs in the COTS product, which were not identified by the vendor during their testing phase. Frequently, the vendor does not deliver a patch on time or does not respond to the implementer's service requests. This can significantly impact the project schedule, especially if the bug hinders the development of a critical feature. Such a risk can be identified and its impact reduced if the development team includes members who have pervious experience in tailoring and deploying the COTS product.

**R5: Undocumented system architecture and business processes (4):** Several maintenance, support and enhancement engagements are initially developed by a different organization. These projects are often times plagued by inadequate documentation of system architecture and business processes implemented by the systems. Such risks increase the time required by the maintenance teams to understand the system operations. Moreover, because of personnel turn-over on the project it becomes essential to reverse engineer the documentation out of pervious meeting notes, and any such available data.

**R6: High quality of service expectations from the COTS products being used by the client (3):** Often times the COTS product selection step is executed by a third-party organization (step P2 in Figure 1) that has limited experience in implementing solutions using the selected COTS product. In such scenarios, they assure the client that their recommended COTS product will meet the quality of service (QoS) parameters required for the system. In practice however, the COTS may not be able to meet these required QoS parameters. It is up to the implementing organization (performing steps P3 and P4 in Figure 1) to curtail client expectations for the QoS parameters supported by the system. This is a risk which often becomes a problem when there has been little or no prototyping done during the COTS selection phase. At this point the client is left with 2 options: make do with the QoS provided by the selected COTS product, or go back and choose another COTS product.

Prior knowledge of such commonly occurring risks is vital to success of projects developing COTS-based systems in a global setting.

## 4. Conclusion

COTS-based development in a global setting is a challenging undertaking. Organizations with limited outsourcing experience frequently stumble upon several risks which eventually increase the project budget and schedule. Our interviews with representatives from 23 projects at Infosys revealed some commonly occurring risks pertinent to global delivery and COTS-based development. These risks, their impact on the project and mitigation strategies have been highlighted in this paper. Prior knowledge of these risks will forearm both organizations using the global-delivery model to provide client services, and clients outsourcing and off shoring software development and implementation projects.

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