# PERFORMANCE AND PREFERENCES OF SOFTWARE DEVELOPMENT ACROSS GEOLOGICAL LOCATIONS: A TESTAMENT ON COST AND QUALITY

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## ABSTRACT

*Software development process involves four stages "4D" namely Discovery, (conceptualization, requirement analysis), Design (high-level design, low level design) Development (coding, testing) Deployment (delivery, support and maintenance). These stages roughly mix and match a high degree of integration and differentiation of Information and inputs for decision making. Few projects are executed onsite or near site and others offshore or away from the client and many a blend of onsite and offshore. There is a need to strike a balance to identify the extent of work that needs to be executed onsite and balance offshored looking into the cost and the efficiency advantages and its impact on the quality of the software, project governance and deliverables. This study takes a sample of companies registered with NASSCOM, and having business into projects, products and process spread across onsite and offshore geographies. Twohypotheses were tested and the outcome of the study provides greater insights to business managers, project managers and academicians to develop a suitable offshore onsite profitable mix. The study also reveals the degree of comparative cost advantage of project execution at offshore and the software quality is independent of the location of its development.*

***Keywords:*** *Comparative cost advantage,Onsite offshore profitable mix, Project life cycle, Stages of software development, Software quality.*

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## INTRODUCTION:

Overcoming the limits, much beyond the imagination of the crystal gazers of the globe, Indian Software Industry has proved itself to be a world class.Abundant supply of technical human resources and greater demand of information technology hubs have resulted in making India a preferred destination for global Information Technology Research centers and business process outsourcing.One of the other factors that is tempting and triggering for offshoring the work to India is the relatively cheaper direct cost of service.This alone reduces the cost on one side but increases several management challenges(Krishna et al 2004, Heeks et al 2001).

Indian software industry has carved a niche by itself as a knowledge economy and accounts to about 6.5 % of the country's GrossDomestic Product (GDP) This sector has aggregated revenues in excess of US $ 88 billionfor the FY 2011 while providing employment to a significant number close to 2.5 million and NASSCOM expects the revenues to increase toUS$225 billion by 2020. More than 3/4$^{th}$ of the revenue would be sourced from exports.

Such being the growth potential of the industry, the companies in the industry also needs to gear up for the growth. The responsibility centers of these organizations needs to nurture the bottom lines of the projects.

The Project and Business Managers are confronted with basic questions like the ones, Should the project be executed onsite or offshored?What should be the mix of onsite and offshore work, what other factors are prominent and have proximity to the profitability? There are two hypothesis that have been tested by collecting the primary data through own field work.Companies which are registered with NASSCOM and having business into Services (projects), generic software products (proprietary products) called as the products sector and IT enabled services which provide solutions and services and having operations at onsite and offshore were considered for the study. The outcome of the study helps the Mangers with the crucial and critical information to execute the project onsite or offshore it and various factors affecting the profitability and the quality of the software development.

## REVIEW OF LITERATURE:

**Davis, et al. (2006)** observed that there is an increased importance and risk involved in the offshoring of the projects. There is a considerable advantage in outsourcing associated quite a bit of risk as well due to the fact of cultural and regional difference.

**Scott (2004)** points at an increased understanding of difficulties inherent in offshoring the project and he also observed that few other aspects like the hidden cultural, structural, legal and financial risks and costs are often ignored.

**G Krishna and S Krishna (2005)**put forth a model for onsite – offshore mix. The paper explores the need to maximize the offshore gain and to identify the absolute need of onsite presence.The real gain in offshoring the project depends on to the project complexity. A single variable called the project complexity is considered and analyzed for the offshore and onsite mix. It was observed that, majority of the offshore gain was lost due to the fact of the project complexity on single stage execution. The large wage difference between offshore and onsite was shaded and faded away by the project complexity.

**Carmel and Agarwal (2002)**explained the difficulties in the projects that are split globally, onsite and offshore. The difficulties lie in the differences of culture, time zones,language, skill differences and working hour differences. They also observed that one of the majordifficulties was in respect of high employee turnover in India. They also identified the difficulties faced by the lack of domain knowledge across globally and offshore unit and poor telecommunication infrastructure.

**Suma Athreye and AshishArora (2001)**assessed the contribution of software to India's economic development paying particular attention to the role of the software in the absorption of labor and the development of human capital in the Indian economy. They have observed that the undifferentiated and service nature of Indian software firms has meant that human capital has acquired an importance that was hitherto reserved for financial and physical capital in Indian industry. In an extremely competitive international market for software services, Indian firms have tried to emphasize the quality of procedures and human resource used by them to gain competitive advantage. It was emphasized in this study that not only the cost advantage is important for off shoring the project but it is also the human factor that attracts the projects. Hence there is a need to nurture this skill by constant improvement by training.

## NEED FOR THE STUDY:

The Information Technology industry cuts across and categorizes itself into custom developed software (projects) called as the services sector secondly packages or generic software products (proprietary products) called as the products sector and thirdly IT enabled services which provide solutions and services.

The companies in this industry may be exclusively into customized software development on a particular vertical market segments or domain areas, like retail, banking, telecom and manufacturing. Software proprietary products may be targeted to a vertical segment or may cut across segments, but very rarely to a specific user. Information Technology Enabled Services Companies provide "solutions", and services which may involve some combination of custom developed software and commercial off-the-shelf software and hardware products. Software development process involves four stages "4D" namely Discovery, (conceptualization, requirement analysis), Design (high-level design, low level design) Development (coding, testing) Deployment (delivery, support and maintenance). These stages roughly corresponds a lot of integration and differentiation of Information and inputs for decision making. These are broken down into iterations developed at various locations and degrees and levels.

Few projects are executed onsite or near site and a few offshore or away from the client and many a blend of onsite and offshore. There is a need to strike a balance to identify the extent of work that needs to be executed onsite and the rest offshored looking into the cost and the other efficiency advantages.

## OBJECTIVES OF THE STUDY:

1. To know whether cost is the only parameter that governs the mix of offshore versus onsite software development.
2. To know the offshore versus onsite profitability.
3. To understand the optimal mix of Offshore and Onsite software development.
4. Toknow the impact of offshoring on the Quality of the software development.

## STATEMENT OF HYPOTHESIS:

1. H1. Cost is the only parameter to decide the offshore versus onsite mix
2. H2. Software Quality is independent of the location of its development.

## RESEARCH METHODOLOGY:

Survey method is used to collect the primary data for this investigation. The structured questionnaire, personal discussions with executives of IT and ITES companies, personal observations, etc., are used in the survey. The questionnaires were distributed in person or through emails in many cases to the executives with a request to fill it up.

## SAMPLING TECHNIQUES AND DESCRIPTION OF THE SAMPLE:

92 companies which were into Projects (Services), Products and ITES (Process), registered with NASSCOM which implemented CMMI Levels were selected for the study. However in

verifying the majority of objectives and testing the hypotheses the responses, stratified random sample of 77 companies were taken in account. Of these 77 companies, 51(66%) are into IT services and 13 (17%) were into ITES and 13 (17%) were into products.The collected data was entered into Microsoft Access. With the help of database queries, classification and grouping of data is done on the basis onsite versus offshore serviced. The classified and grouped data is transferred to SPSS.15 version for statistical analysis. For testing the hypothesis f test (ANOVA table) was used. Variables in isolated manner may not be useful, so study used cross tabulations for various parameters across the size of the company, type of service and various levels of Capability Maturity Models Integration

## ANALYSIS AND INTERPRETATIONS:

**Table 1: Stages of development and Location of Development Centers**

(N=77)

| Location | Discovery | | Design | | Development | | Deployment | |
|---|---|---|---|---|---|---|---|---|
| | A | | B | | C | | D | |
| | Count | Percent | Count | Percent | Count | Percent | Count | Percent |
| Onsite | 57 | 74%B | 22 | 29% | 5 | 6% | 8 | 10% |
| Offshore | 18 | 26% | 55 | 71% | 72 | 94%A | 69 | 90% |

Results are based on two-sided tests with significance level 0.05          (Source: Survey)

It is clear from the above table that out of the 77 companies, almost 74% of the companies had their Discovery / conceptualization, requirement analysis stage executed onsite, while 26% had done the same offshore. On the contrary 71% of the design happened offshore, while 94% of the development happened Offshore and 90% of the deployment at offshore.

In stage of development and location comparison, during Discovery stage Onsite location is significantly higher when compared to offshore. Similarly, offshore seemed to be a preferred destination for development stage as it is significantly higher when compared to onsite Development.

It is quite evident from the table that whatever is the type of service the company is into, but still it has its software development center over here in India (offshore). All the projects will be acquired from the onsite office and later on it is offshored to India to reduce its overhead cost. GenerallyDiscovery phase happens onsite (outside India) later on the Design and Development phase is carried out at offshore eventually it is deployed onsite.

The companies have their onsite locations basically to source the projects and liaison(account management activity) with the clients. All the design and development of the software is offshored and terminally is deployed onsite.

**Table 2: Weightage of Factors considered while deciding the onsite – offshore mix**.

(N=77)

| Location | Cost benefits | | | | Quality Management & Efficient Delivery | | | |
|---|---|---|---|---|---|---|---|---|
| | Onsite | | Offshore | | Onsite | | Offshore | |
| | A | | B | | C | | D | |
| | Count | Percent | Count | Percent | Count | Percent | Count | Percent |
| IT Services | 9 | 64% | 27 | 69% | 8 | 67%D | 7 | 58% |
| ITES | 3 | 21% | 5 | 13% | 2 | 17% | 3 | 25% |
| Product | 2 | 14% | 7 | 18%C | 2 | 17% | 2 | 17% |

Results are based on two-sided tests with significance level 0.05      (Source: Survey)

It is evident from the table that when cost and other factors like Quality Management and timely deliveryare considered, 69% of the companies in IT Services had the cost benefits if the project is executed offshore, but 67% of the companies had the quality management and efficient delivery benefits if the project is executed onsite.

Quality Management and Efficient delivery was significant if the project was executed onsite. Hence it can be concluded that cost is not the only criteria while deciding to execute the project across locations.

**Table 3: Percentage of cost savings – Offshore Versus onsite**

(N=51)

| Cost Savings | Discovery | | Design | | Development | | Deployment | |
|---|---|---|---|---|---|---|---|---|
| | A | | B | | C | | D | |
| | Count | Percent | Count | Percent | Count | Percent | Count | Percent |
| 10-20% | 4 | 44% | 3 | 27% | 5 | 24% | 3 | 33% |
| 20-30% | 3 | 33% | 3 | 27% | 6 | 29% | 2 | 22% |
| 30-40% | 2 | 22% | 5 | 45% | 10 | 48%A | 4 | 44% |

Results are based on two-sided tests with significance level 0.05(Source: Survey)

22% of the IT Services companies felt that there is a cost savings of 30-40% during Discovery stage, while there will be a bit of travelling involved, but the duration of the stage is minimal of the project life cycle, But 48% of the companies experienced a cost savings of the tune of 30-40% during the development stage, which is the longest stage of the project life cycle. Since development stage is allocated with greater resource utilization, and 48% of the companies experienced 30-40% cost savings which is significantly higher when compared to any other stages across locations.

## HYPOTHESIS TESTING:

**Anova test for parameter differences about offshore onsite mix.**

**Table 4:Analysis of variance on parameters considered for Offshore Onsite mix.**

| | | Sum of Squares | Df | Mean Square | ANOVA-Table | |
|---|---|---|---|---|---|---|
| | | | | | F-value | Sig. test (p-value) |
| Cost benefits | Between Groups | 0.132 | 2 | 0.066 | 0.255 | 0.775* |
| | Within Groups | 19.089 | 74 | 0.258 | | |
| | Total | 19.221 | 76 | | | |
| Quality Management & Efficient Delivery | Between Groups | 0.424 | 2 | 0.212 | 2.324 | 0.105* |
| | Within Groups | 6.745 | 74 | .091 | | |
| | Total | 7.169 | 76 | | | |

Since the p value is > 0.05, at 95% CI, the hypothesis H1 is rejected. This indicates that cost is not the only sole criteria to be considered to decide to execute the project to run onsite or offshore.

**Anova test for quality differences about offshore onsite mix.**

**Table 5: Analysis of variance on quality of project across locations**

| | | Sum of Squares | Df | Mean Square | ANOVA-Table | |
|---|---|---|---|---|---|---|
| | | | | | F-value | Sig. test (p-value) |
| Offshore | Between Groups | 1.761 | 4 | 0.440 | 2.732 | 0.036* |
| | Within Groups | 11.437 | 71 | 0.161 | | |
| | Total | 13.197 | 75 | | | |
| Onsite | Between Groups | 9.180 | 4 | 2.295 | 2.862 | 0.029* |
| | Within Groups | 56.925 | 71 | 0.802 | | |
| | Total | 66.105 | 75 | | | |

Since the p value is < 0.05, at 95% CI, the hypothesis H2 is accepted. This indicates that there is no impact of the location factor on the quality of the software development.Hence software quality is independent of the location of its development.

## MAJOR FINDINGS:

According to the study, majority of the Discovery phase would be executed onsite (outside India) later on the Design and Development phase which is relatively longest of the Project life cycle is carried out at offshore.This would be an ideal offshore and onsite mix.

About 74% of the companies do have the discovery phase executed onsite but 94% of the companies have the development phase offshored in to India.

Though the companies take a bit of cost on the onsite for Discovery phase, it is found worth it due to the fact of better and proper conceptualization and requirements analysis gathering rather than having it offshore and later on compromising on the quality and project deliverables.

Offshore development is a preferred location of software development due to the cost advantage of around 30-40%. However Discovery can be kept onsite,having development stage offshored.

Quality Management and effective delivery, along with cost are the parameters considered before deciding the option of finalizing the location.

## CONCLUSION:

This investigation has been directed towards both the project managers, business managers and academics with greater insights into the optimal mix of offshore and onsite. The study focused two different perspectives, the cost and the quality of the project.Discovery phase can be executed onsite, face to face with the client to elicit a proper conceptualization of the project and later offshored for development followed by the design to have the comparative cost advantage of 30-40%.It can be concluded that cost is an important factor but not the only important factor to decide upon the location of running the project however quality management and project deliverables needs to be factored before executing the project / product / process.

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