

# Comparing Software Project Risks: India and other Nations

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Failure of software development projects is a common phenomenon in many organizations around the world. Literature indicates shows scarcity of relevant research in India though several studies on risk related constructs are done in developed countries. This research was formulated with an objective of studying software development project risk in the Indian context. The top software project risk factors in India are identified and are compared with those in the developed and underdeveloped countries. The study shows the importance of variation in risk factors vis-à-vis the socio-economic context and the cultural setting.

Software failure still exists despite huge advances in development techniques, tools, and technologies. Software development suffers from cost overruns, time overruns and quality problems To avoid these problems, it is frequently recommended that the risk associated with a software project be managed strategically.

The Standish Group research shows that a staggering 31.1% of projects will be cancelled before they ever get completed. Further results indicate that 52.7% of projects will cost 189% of their original estimates. (Standish survey,1995,1999). Most software projects take place in an unpredictable environment in which many pitfalls exist that may affect the successful outcome of a project (Barki ,1993). A task that is critical to the proper management of software development risk is the assessment of the risks facing the project. (Charette, 1996; SEI, 1996). A software project risk points to an aspect of a development task, process or environment, which if ignored will adversely affect the success of the software project. (Lyytinen et al., 1993, Barki et al. 1993, Boehm, 1991, Charette, 1996; Lyytinen, 1998, McFarlan, 1981).

## **The Research Purpose**

Various research studies have identified the major risk factors affecting software development. But most of these studies address software risk in developed countries with sophisticated software development infrastructures and have come out with generalized conclusions. This has been acknowledged as a major limitation of the research on software development risk (Ropponen, 1997).

India is now being positioned as the software development hub of the world. The working environment in software companies in India is different from that of US. Many researchers acknowledge that cultural differences can impact work related values and play a significant role in the success or failure of projects (Hofstede, 1980).

The validity of the findings from international studies on software development project risk needs to be verified in India. Thus, the purpose of this research was (1) to identify the most important risk factors prevailing with software development projects in India (2) to compare the top risk factors in Indian projects with those identified in International studies.

### **Literature review**

Cambridge Learner's Dictionary defines "risk" as the possibility of something bad happening. A simple definition of project risk states that it is a problem that has not yet occurred but which could cause loss to one's project if it did (Wieggers, 1998). A software project risk points to an aspect of a development task, process or environment, which if ignored tends to increase the likelihood of software project failure (Lyytinen et al., 1993). McFarlan (1981) viewed project risks as failure to obtain all of the anticipated benefits because of implementation difficulties, much-higher-than-expected implementation time, and thus resulting in the development systems whose technical performance is considerably below estimates. Many researchers have identified top risk factors present in software development projects. They have used different approaches including case studies, action research, surveys and theoretical work on this topic (Ropponen, 2000).

One of the pioneering studies in this regard is the top 10 risk list of Boehm (1991). His list has been compiled by probing several large software projects and their common risks and is thus empirically grounded. The top ten items are: Personnel Shortfalls, Unrealistic schedules and budgets, Developing the wrong functions and properties, Developing the wrong user interface, Gold-plating, Continuing stream of requirements changes, Shortfalls in externally furnished components, Shortfalls in externally performed tasks, Real-time performance shortfalls, and

Straining computer-science capabilities.

One of the most quoted international studies on software project risk factors was conducted by Schmidt et al. in 1996. In an attempt to compensate for some of the previous shortcomings in checklists of risk factors, Schmidt et al. (1996) conducted a survey of project managers and developed an extensive list of risk factors in software development. Their research was accomplished through three simultaneous Delphi surveys in three different settings: Hong Kong, Finland and the United States. In each country, a panel of project managers was formed and a "ranking-type" Delphi survey was used to solicit risk items from the panel. These risk factors were then consolidated into a comprehensive list of software project risk items. The initial list produced by the expert panels was grouped into 53 unique risk items and then further reduced to a list of 11 risk factors common to all countries. These factors are Lack of top management commitment to the project, Failure to gain user commitment, Misunderstanding the requirements, Lack of adequate user involvement, Failure to manage end user expectations, Changing scope/objections, Lack of required knowledge/skills in the project personnel, Lack of frozen requirements, Introduction of new technology, Insufficient/inappropriate staffing and Conflict between user departments. It was seen that the ranking of the factors varied significantly across the countries.

Keil et al (1998) improved upon their international Delphi study exploring the issue of IT project risk from the user perspective and compared it with risk perceptions of project managers. By understanding the differences in how users and project managers perceive the risks, insights could be gained that may help to ensure the successful delivery of systems. The Delphi study revealed that these two stakeholder groups have different perceptions of risk factors. Through a comparison with Schmidt et al. (1996) study on project manager risk perceptions, zones of concordance and discordance were identified. Anja Mursu (2000) repeated Schmidt et al's Delphi study design in Nigeria to identify the major software development risks. The study produced a rank-order list of software risk factors which are significant different with the rankings of the earlier study.

## Research Methodology

The current research design is descriptive in nature. Questionnaire method was used for data collection. The risk factors in a software development project are measured by collecting data from professionals involved in software development project teams.

## Questionnaire Development

An exhaustive literature survey was conducted to prepare a comprehensive list of risk items present in software development projects. This was done by assembling risk items from major checklists such as Wallace (1999), Barki (1993), Boehm (1990), Schmidt et al. (1996), Moynihan (1997) and SEI (1993). India specific risk items were also added. This resulted in a draft questionnaire with 118 items. The respondent had to indicate the presence of each risk item in his/her project on a five point Likert scale (strongly disagree; disagree; neither agree nor disagree; agree and strongly agree).

The draft questionnaire was given to five senior software professionals from the industry and five senior professors in software engineering. The experts were requested to critically examine the questionnaire, and to give objective feedback and suggestions with regard to the comprehensiveness/coverage, redundancy level, consistency and number of items in each variable. Based on the feedback from experts, a 'pilot questionnaire' was formed containing 73 items.

The pilot questionnaire was administered to a sample of software professionals with at least one year of software project experience. The goal of this exercise was to eliminate items that did not contribute significantly to the value of the instrument.

The data collected from the pilot group was scrutinized to identify the no response questions as well as low item-total correlations questions. The final instrument had 55 items measuring the risk construct

## Data Collection

The final data was collected from the NASSCOM listed companies in Chennai, Bangalore, Cochin, and Trivandrum. Data were collected from different types of projects and members in different roles but keeping the condition that only one response should be solicited from one project. The final data set had 527 usable records representing 527 projects from 95 companies.

Exhibit 1 shows the distribution of sample projects

Sl. No.	Domain	Percent (%)
1	Business Application	48.3
2	Engineering Application	20.2
3	System Software	10.5
4	Web Application	17.5
5	Others	3.8
	<b>Total</b>	<b>100</b>

## The rank order of risk factors in India

The data were coded as below

- 1- Strongly disagree; 2- Disagree; 3- Neither agree nor disagree; 4- Agree; 5-Strongly agree.

A higher score indicated higher presence of the risk item. The average score for each risk item was calculated across the responses from the 527 projects. The risk items were then sorted on the basis of this score. The top 10 risk items identified are reported in exhibit 2.

## Exhibit 2: Top 10 risk items in the Indian software projects

Rank No	Risk Item
1	Adequate time was not spent on various phases of software development (like coding, testing, documentation)
2	The project required a change in currently used tools and techniques
3	The project requirements were changed continually
4	Responsibilities for project task assignments were not clearly defined
5	Large number of links were required to other systems
6	The work pressure was so high that most of the employees had to work beyond the office hours
7	The project was over dependent on a few key people
8	Project manager had multiple projects to manage at the same time.
9	Inappropriate development methodology was used in this project
10	Resource requirements were incorrectly estimated

As reported in Exhibit 2, the major risk variables in Indian software projects relate to project planning issues like inadequate time spent on various phases of software development, not clearly defining the responsibilities, one person managing multiple projects, frequent requirement changes and incorrect estimation of resources. Technical issues like change in tools and technologies, selection of inappropriate methodology for software development and attempts to make the software compatible with a range of other systems find

slots in the top ten risk set. Team/personnel related variables namely too much work pressure on employees and over dependence on few people are the remaining risk variables in the top “10” list.

### Comparison risk factors

A comparative table was prepared to understand the similarities and differences between the top risk factors in six international location,. This is shown in exhibit 3.

**Exhibit 3: Ranking of Risk items in various countries**

Risk Items	India (present study)	USA (Schmidt)	FIN (Sch midt)	HKG (Sch midt)	Nigeria (Mursu)	Boehm*
Adequate time was not spent on various phases of software development	1					
The project required a change in currently used tools and techniques	2	4		3		
The project requirements were changed continually	3	6	8	8		*
Responsibilities for project task assignments were not clearly defined	4					
Large number of links were required to other systems	5					
The work pressure was so high that most of the employees had to work beyond the office hours	6					
The project was over dependent on a few key people	7					
Project manager had multiple projects to manage at the same time.	8					
Inappropriate development methodology was used in this project	9	8	10		2	
Resource requirements were incorrectly estimated	10					
Misunderstanding the requirements	20	2	5	7	1	
Lack of required knowledge/skills in the project personnel	24		2		3	*
Lack of skilled personnel					4	
Under funding of development					5	
Import of foreign packages					6	

## Discussion

The risk factor ranking of Indian software projects are compared with the rankings obtained in international studies. Certain critical differences are found between the findings in Indian context and other studies.

The study of Schmidt et al. (1996) showed eleven items that are common in US, Finland, and Hong Kong out of which only three items figure in the “top 10” and six items get into the “top 20” in the Indian context. And a single factor overlaps between the “top 10” list of India and that of Nigeria.

However, five factors show relative levels of overlap across lists. They are

- Instability in requirements
- Change in technology / tools
- Inappropriate development methodology
- Misunderstanding the requirements
- Failure to gain user commitment

Requirement changes occurring during the project is a major risk. It implies first of all, certain lacunae in the process and procedures involved in ‘requirement analysis’. Second, a lack of clarity or purpose on the part of the users - that they just want to introduce the technology without any proper strategic planning. Third, the lack of clear and open communication on an ongoing and pro-active basis between the software development team and the user.

Another risk is about insufficient technical knowledge of the project management team in terms of selecting the appropriate methodology and techniques. This indicates the need for project managers as well as the team to maintain pace with new techniques and tools as they emerge.

User related factors were rated high in risk in the international studies. Four out of the top 11 risk factors were found to be connected with the ‘user’ in the study of Schmidt et al. It reflects the difficulty in managing relationships with users in a productive manner. This risk seems to be reducing in India due to improvements in customer relationship management and also with the increasing software knowledge of the users.

‘Lack of Top Management Commitment’ was chosen as the most important risk factor by the IT experts in the US, Finland, and Hong Kong. In India this factor, however, is ranked low. This can be attributed to the fact that the present study is conducted in software development companies unlike the foreign studies in which the data were from software projects executed with manufacturing and hardware development companies.

The infrastructure related risk factors which had the high rating in Nigeria seem to be insignificant in India. The software development infrastructure in India is becoming comparable to that of the developed world.

India reveals its own unique set of risk factors in the list. Many of them are related to poor manpower planning. Lack of resources, employees being forced to work outside the stipulated hours, and one person manning multiple jobs; along with Regulatory and social issues are the top risk items figuring in India. Besides, visa rejections and social restrictions on women traveling and staying outside are the two risk items found exclusive to the Indian sample.

## Conclusion

This paper reports a study on ‘risk identification and ranking’ conducted in India. The results show that there are several important differences between the India sample and other locations in terms of identified risk factors and their ranking. However, a small but important set of generic risks are common to all socio-economic contexts. These are linked with requirement analysis and application of tools and technology. The notable differences among countries relate to risk issues connected with top management, users, and regulatory agencies.

The study points out to the requirement on the part of project managers to recognize the role of ‘culture differences’ between countries in determining the nature and extent of risks. As software development organizations set up units across the globe to leverage on cost and skill advantages, it is very important for the project managers to understand the relative differences in risk factors.

Proper identification of risk associated with software development projects in a development

context and application of appropriate risk management strategies can reduce project failures. Organizations can check for the presence of the top risk factors at multiple points during a project and track the changes in risk in a project as it progresses. Then they could monitor the risk mitigation strategies selected to counteract risk and by re-assessing risk at a later point they could determine the effectiveness of their strategy.

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